Electrical Review

Vol. 76—No. 23. CHICAGO, SATURDAY, JUNE 5, 1920. Page 929.

Hydroelectric Development at Muscle Shoals

Description of Water-Power Plant and Dam Across the Tennessee River, Built to Provide Power for Nitrate Manufacture—Auxiliary Steam Plant to Carry Load During Low-Water Season

By WILLIAM B. WEST

The building of a nitrate plant at Muscle Shoals by the United States government involved the construction of a complete steam power plant and a hydroelectric plant with the largest dam in the country. The dam, called Wilson dam, is rivaled in size only by the Assaun dam in Egypt and the Vyrnwy dam in England. The construction of the Wilson dam, when finally completed, will make the Tennessee river navigable for almost its entire length, thus opening up a great new territory to water transportation in addition to supplying a fairly large amount of power.

When completed the Wilson dam will be 4151.91 ft. long, 96 ft. from bed rock to pool level, and will contain approximately a million yards of masonry. The footing on bed rock varies in width from 70 ft. to 150 ft. and the roadway over the top is 23 ft. wide, the total top width of the masonry work being 27 ft. 6 ins. The masonry of the dam is keyed to bed rock by a concrete key cast in a trench 10 ft. or more deep by 20 ft. wide running across the entire length of the structure and flush with its stream face. A second key, wider, but not so deep, is located approximately at the downstream edge of the footing.

The spillway sections have parabolic shaped crests designed and built in accordance with the equation, $Y^2 = 35x$. The parabolic crest tapers into a straight line with a batter of 0.8395, which straightens out to meet the bed rock in a curve

Fig. 1.—General View of Location Where Wilson Dam Is Being Built.

Fig. 2.—Cofferdam Crib Construction at Wilson Dam.

with a radius of 41 ft. 2.75 ins. There are 24 permanent sluices, 9 ft. in diameter and built on 11 ft. 6 ins. centers, just above bed rock in the section of the dam beyond the power plant. The power plant occupies a space approximately 900 ft. long below the south end of the dam proper. An inspection tunnel runs through the length of the dam and a special tunnel gives access to the mechanisms operating the sluice gates. A special trash channel is provided through the intake sections to provide for the removal of floating debris which is discharged directly over the down-stream side of the dam.

Fig. 1 shows the excavation work in progress preparatory to building the dam proper. It will be noted that railway tracks were constructed on the concrete work at the right for use during the construction period. Another track is shown on the left running along the top of the cofferdam. The crib work construction for the cofferdam is shown in Fig. 2.

Hydroelectric Plant.

Provision is made in the hydroelectric plant for the installation of 15 generators of 20,000-kw. capacity, making an ultimate station capacity of 300,000 kw. The machines are to be installed in a single row, 57 ft. on centers. The plant, as previously stated, is located on the down-stream side of the south end of the dam. The

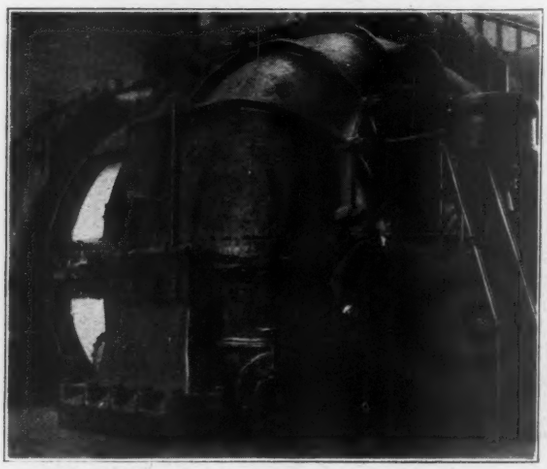


Fig. 3.—Transformer Installation in the Nitrate Plant at Muscle Shoals.

waterwheels are located at a position between the high and low-water tail-race level, the generators being mounted above the wheels in a position slightly above the high-water tail-race level. Water is admitted to the wheels through racks, screens and suitable gates and is led through the dam structure by tubes approximately 20 ft. in diameter. The horizontal travel of the water through the dam, turbine and draft tube is 147 ft. Tail-race water levels are anticipated to vary by 32 ft. and the water level above the dam at high-water seasons is expected to be 70 ft. above the tail-race. When fully equipped, the plant will be able to supply a large amount of power to industrial consumers as well as providing power for the nitrate plant. During the low-water season the loss in hydroelectric capacity will be made up by the operation of a steam generating plant. Such a combination of steam and water plants makes possible the utili-

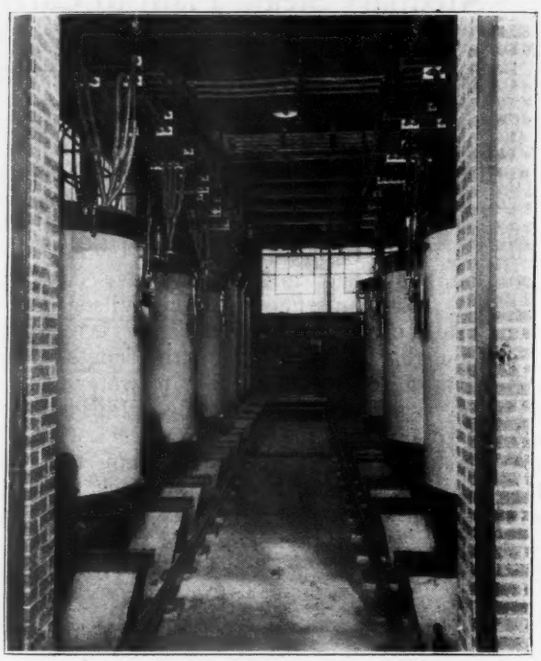


Fig. 4.—View of One Unit of the Steam Turbine Installed in the Auxiliary Generating Station.

zation of a much greater percentage of the available water power than where only a hydroelectric installation is made.

Auxiliary Steam Power Plant.

Work on the steam power house has been completed and part of its equipment has been placed in service. The boiler room contains 12 Babcock & Wilcox water-tube boilers of 1500-hp. capacity each, built for a pressure of 275 lbs. per sq. in. A three-unit turbine, rated at 26,666 hp. per unit, is installed in the generator room. The high-pressure unit takes steam at the boiler pressure of 275 lbs. and exhausts at 50 lbs. per sq. in. into each of the two low-pressure units. Space is provided in the turbine room for the installation of an additional machine of 40,000-hp. capacity, at such time as additional service is required. Two synchronous condensers are installed in the turbine room for power-factor correction. Jet condensers are located in the basement just below the low-pres-

Views of Muscle Shoals Power-Plant Project

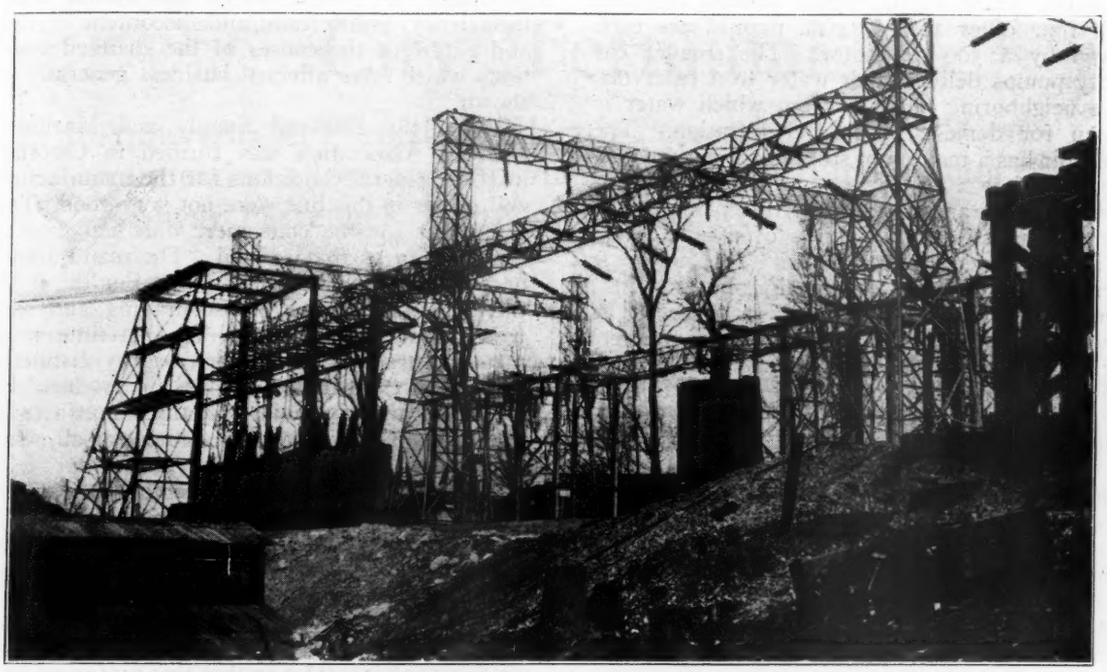


Fig. 5.—General View of Outdoor Substation and Line-Supporting Structures at the Muscle Shoals Power Plant.

Fig. 6.—Construction Scene at Wilson Dam.

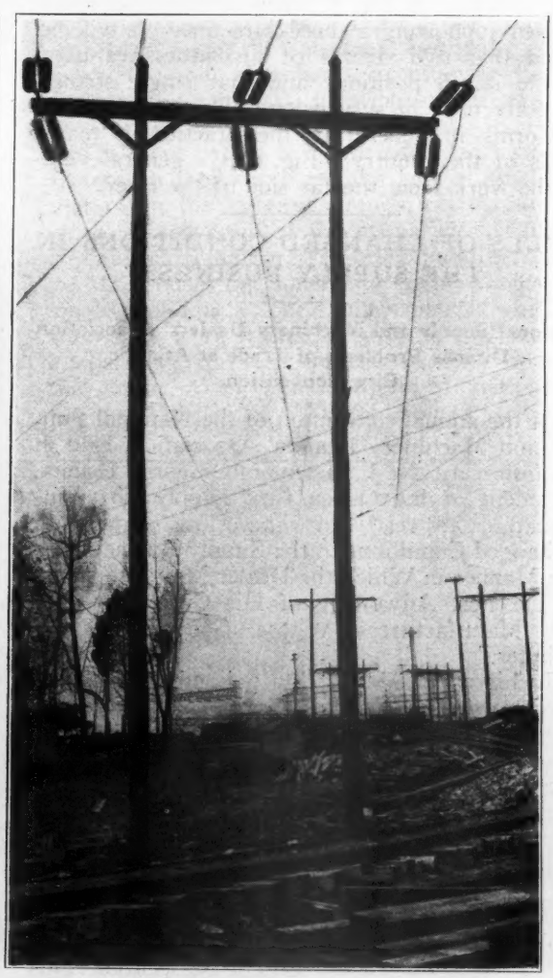


Fig. 7.—A Two-Pole Transmission-Line Tower.

sure turbine units which they serve. The four circulating pumps supplying condenser water are located in the basement, and have a capacity of 40,000 g.p.m. each. These pumps, together with four other 10,000-g.p.m. pumps, are each driven by a 500-hp. motor. The smaller capacity pumps deliver river water to a reservoir on a neighboring hill top, from which water is drawn for domestic use after filtration. The reservoir has a maximum storage capacity of 60,000,000 gal.

Energy is transmitted from this plant to the nitrate plant, about two-thirds of a mile away, at a pressure of 12,200 volts. The power is carried by copper buses 4.25 ins. by 0.25 ins., through a tunnel-like housing 16 ft. square. The buses are separated from each other by concrete barriers run through the housing.

Fig. 4 shows an illustration of a portion of the transformer installation in the nitrate plant. The transformers shown are of 1600-kw. capacity and reduce the voltage from 12,000 to 2300 volts. The method of installation and the character of work on connections and supports is clearly shown. An outdoor substation at the generating plant is shown in Fig. 5. This illustration gives a good representation of the general construction features, showing bus and line supporting towers, transformers and other details. The use of suspension insulators in various positions is well shown in this illustration and also in Fig. 7, where a two-pole tower is seen supporting a three-wire line. It will be noted that two strings of insulators are used in the strain positions and that single strings only are used in suspension. This construction conforms in general to the practice in many parts of the country. Fig. 6 is a general view of the work from the far side of the river.

TELLS OF CHANGED CONDITIONS IN THE SUPPLY BUSINESS.

National Supply and Machinery Dealers' Association Discuss Problems of Trade at Atlantic City Convention.

At the annual convention of the National Supply and Machinery Dealers' Association, held in Atlantic City, N. J., last month, George Puchta, president of the Queen City Supply Co., Cincinnati, O., read an interesting paper on "Changed Conditions in the Supply Business and the Manner in Which the Dealer May Use Them to the Best Advantage of His Customers, and the Manufacturers Whose Goods He Distributes."

In his paper Mr. Puchta pointed out that the recent war has changed all conditions throughout the entire world and surely has changed business conditions. Millions of men volunteered or were called for service from farms, factories, mills, mines, stores and counting rooms. Most of them have returned. Their experiences have given to most of them a broader vision and higher ambition. Others have become discontented and many do not intend to follow their former vocations.

Sufficient farm labor cannot be secured. This is not likely to reduce the cost of food. Immigration, which continually supplied additional labor and added about a million people annually to the population, ceased in 1914. Besides, emigration since 1914 has taken thousands from this country. Add to all of this shorter hours, inefficiency, indifference and discontent of help, and a few of the causes of the changed conditions which have affected business generally are shown.

When the National Supply and Machinery Dealers' Association was formed in Cleveland in 1905, general conditions for the manufacturer and dealer in this line were not very good. They were best for the consumer, who had most of the advantages that existed. The manufacturer had some and the dealer a few. For the dealer the situation was very discouraging and some were about ready to quit. At that time, many manufacturers, without much or any distinction in price, were willing to sell their product alike to dealer and consumer. Many manufacturers had inadequate cost systems or none at all, which made costs to themselves very uncertain.

The manufacturers are to be congratulated on the wonderful progress made in the process of manufacturing and cost accounting. The progress, however, in the actual cost of selling has not been so marked and there are reasons for this. A number of manufacturers have always been liberal and have protected the distributors of their goods, realizing that this was good business and a matter of mutual interest. Other manufacturers have given no protection, believing that in distributing their goods direct to the consumer, they would save the selling cost, thereby deceiving themselves. There are occasions when selling direct to the consumer is necessary and advisable, but it should not be done at the dealer's price or without protecting the dealer.

Two distinct classifications apply to business: first, the producting of the goods, and second, the sale and distribution. Both are expensive and must be paid by someone, either the manufacturer or the dealer. There is no escape, and after these two are taken care of, the first opportunity for profit is presented.

Ideal conditions do not yet prevail, but much progress has been made. The supply business as conducted today is in a higher class than it was formerly. Former conditions, changed conditions, manufacturers, dealers and consumers are all entitled to some credit for this. Former conditions and changed conditions have been wonderful and effective educators. Above all, they have proven that the manufacturer and dealer are essential to each other and can be mutually helpful and "each is worthy of his hire."

Manufacturers must have a profit on their production. To this an additional percentage for selling is essential, whether it be for the manufacturer or the dealer. Experience has proven that in most cases the dealer can distribute for less than the manufacturer. This means that the consumer benefits in prices from the dealer's distribution of goods. The consumer gets prompter service from the dealer whose stock of goods is nearer to him, and from present congested and inadequate transportation conditions the consumer will have this advantage indefinitely.

Electrical Equipment of Kansas City Terminal

Apparatus for Furnishing Electric Power, Lighting and Communication Plays an Important Part in the Functioning of Railway Passenger Terminal Constructed in Missouri City

By ROY W. BUDD
Electrician, Kansas City Terminal Railway Co.

Electric light, power and communication equipment have played a prominent part in the transition from the old dingy railroad station to the modern efficient terminal, and have served in a great variety of ways to make possible the convenience and speed of service given.

Lighting for offices, lobbies, ticket windows, resturants, stairways, entrances, yards, baggage rooms and train sheds must be provided suitable to the location and service. In fact, every phase of the lighting problem is met in the construction of a modern railway station. The telegraph, telephone and telautograph systems, together with the train-calling telephone and visible and audible signal systems, are all used for communication in the operation of the station and for the convenience of the traveling public. Electric elevators, trucks and tractors are used for the movement of baggage and mail, and other types of electric power are used in a great variety of ways. Thus it is seen that every type and character of electrical construction work is required in a modern terminal.

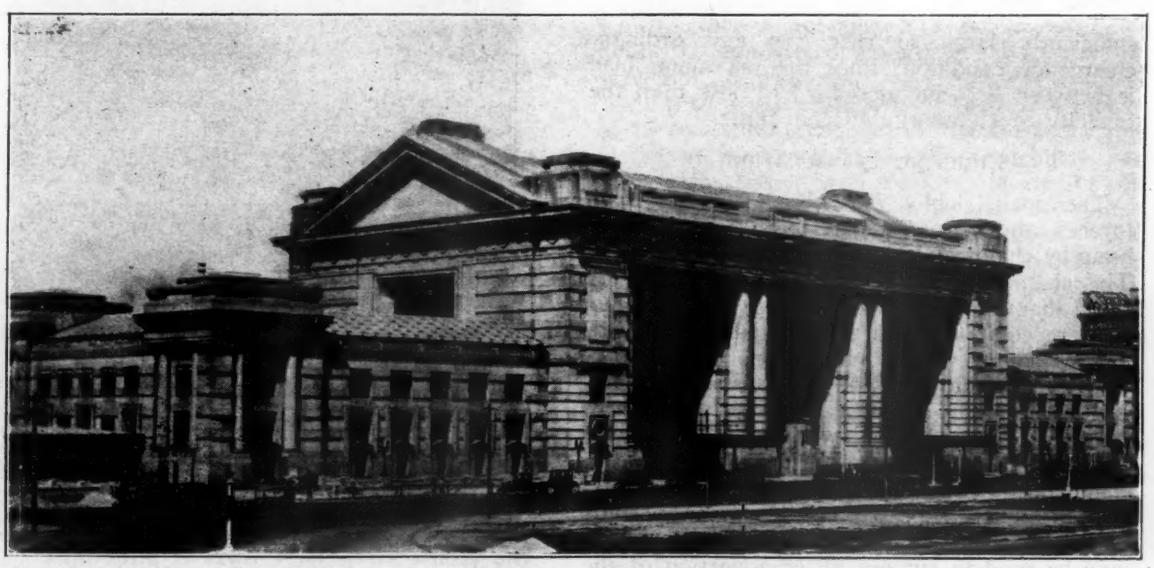
The application of electricity in modern railway terminals is illustrated in the new union station and passenger terminal at Kansas City, Mo., shown in the accompanying illustrations. The main lobby of the station is 100 ft. long by 200 ft. wide, and the waiting room over the tracks is 60 by 350 ft. Access to trains is gained by means of individual stairways from each of the 16 track-platforms to the main waiting room, and all baggage and mail transfer between trains is handled with electric trucks running through a sub-basement. Elevators raise and lower the trucks between the platform and the sub-basement so that there is no trucking across tracks except in emergency.

General Features of Power-Plant Equipment.

The electric service for the entire terminal is supplied by a 2000-kw. generating plant served by 4000-hp. boiler equipment. A 52-ft. switchboard distributes the power to the various feeders serving different panels, cabinets and subdistribution centers. Three-phase, 60-cycle, 2300-volt power is generated, being distributed from 110-volt, three-wire circuits for lighting and from 220-volt, three-phase circuits for general power.

The plant output is measured by 23 watt-hour meters on the power circuits and 41 watt-hour meters on the lighting circuits, all mounted in steel cabinets back of the main switchboard.

An ornamental pressed-brick building, 98 by 200 ft., houses the boiler and engine rooms in a single building. The boiler plant, which is served by a 15-ft. stack 250 ft. high, occupies a space 53 ft. wide by 200 ft. long opposite the engine room, and is equipped with eight 500-hp. Babcock & Wilcox boilers fired by



General View of Union Passenger Station at Kansas City, Mo.

Power Plant Which Furnishes Electricity and Heat for Kansas City Terminal.

chain-grate stokers of the same make. The grates are driven by two vertical steam engines and are arranged to burn slack or nut coal. The boiler-feed lines are served by a Worthington double-action duplex pump and two Terry turbine-driven centrifugal pumps. The feed water is heated by exhaust steam to 212 deg. F. in a Cochrane open heater and is measured by a flow meter.

The engine room is 45 ft. wide by 200 ft. long, being built large enough to provide for additional generating units when required. The existing equipment consists of two 1000-kw., 2300-volt, three-phase, 60-cycle Curtis turbogenerators, and one direct-connected, 125-volt, 35-kw., d-c. turbogenerator. This latter unit is installed as an emergency exciter and for the operation of the 30-ton crane which serves the entire plant.

The switchboard is made up of 13 black slate panels, four of which supply eight 2300-volt, three-phase feeders, one serving the d-c. generator, and two the main units. Two panels are spare and the remaining four are used for metering and exciter equipment. The plant is sufficiently large to care for any ordinary emergency condition, since the maximum load is between 800 and 900 kw., or less than the capacity of either of the main units.

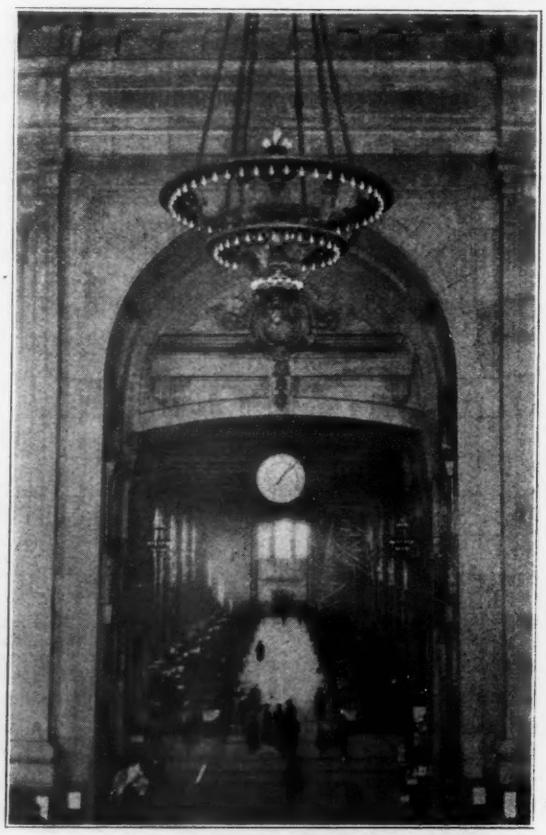
Lighting Installation.

The main lobby is lighted by eight wall torches and three massive bronze chandeliers hung by chains and steel cables from the ceiling. The chandeliers weigh 3200 lbs. each, are 12 ft. in diameter, are wired with 12 circuits each, and are equipped with 125 white-bulb, 50-watt, type C lamps. Each chandelier, which hangs 50 ft. above the floor and 40 ft. below the ceiling, is provided with a motor-driven winch, by means of which it is lowered twice a year for replacement of lamps. The wall brackets and chandeliers are operated by means of remote-control switches located in the station-master's office, and by individual circuit switches which may be used to cut out all or a portion of the lamps when not needed. The remote-control circuits operate master switches located in the regular lighting cabinets.

The main waiting room is lighted with 20 side brackets or torches, each holding 42 white-bulb, 50-watt, type C lamps set in three circles of varying size. A single 100-watt lamp is carried at the top of each of these fixtures. The midways on either side of the main waiting room are each lighted with 64 type C, 100-watt lamps hung in pairs in enameled steel reflectors. The women's waiting room and the smoking room are lighted with 40-watt, frosted lamps hung eight in a group on 3-ft. circular, chain-suspended bronze fixtures.

The lunch room is lighted with three 12-lamp bronze posts and 14 bronze brackets, each holding four 40-watt and one 60-watt round frosted lamps. Ten semi-indirect units, each equipped with four 100-watt, type B lamps, are used in the illumination of the dining room. Semi-direct fixtures with 100-watt, type C lamps, and wall brackets with 25-watt lamps and half-round shades are used for the ticket-office illumination. The telegraph stand, telephone booths, drug store, news stand, candy stand, etc., are lighted with 40, 60 and 100-watt, round, frosted lamps suspended singly or in clusters from the ceiling. Show cases in and about the stands are equipped with 25-watt, 12-in. tubular lights. The sub-basement, tunnels, baggage room, mail room and adjoining ante-rooms are illuminated with 100-watt, type B and type C lamps in bowl-type, enameled steel reflectors, suspended on reinforced drop cord.

Enameled steel reflectors are used in connection with 100-watt, type C lamps to supply light for the train sheds and platforms. This equip-



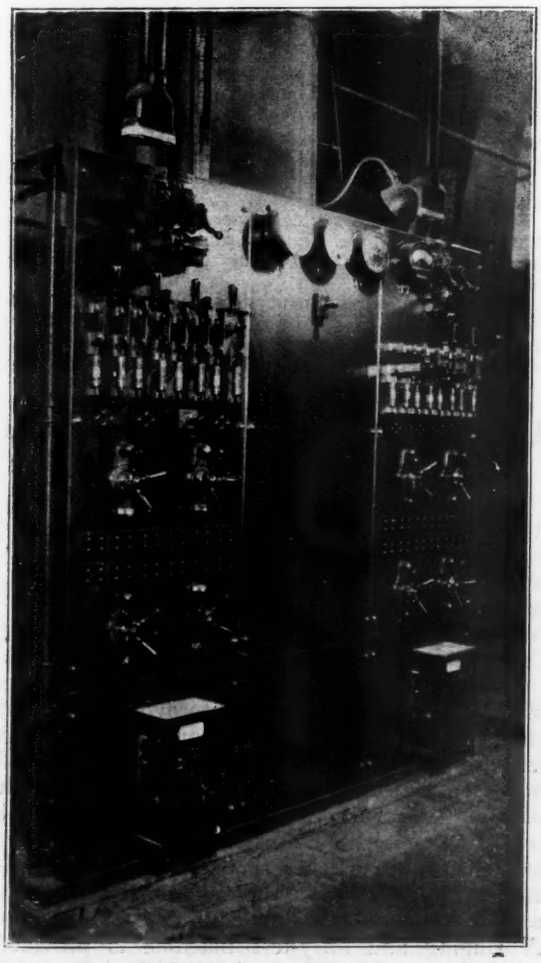
Main Lobby and Waiting Room, Showing One of the Massive Chandeliers.

ment is provided with porcelain sockets and is suspended 18 ft. on centers down the length of the platforms. The stairways leading from the platforms to waiting room are each lighted by a 100-watt, type C and a 60-watt, type B lamp. The yards at either end of the train shed are illuminated by means of four 750-watt, type C lamps mounted on 40-ft. poles and by a number of large floodlights.

Motor-Driven Equipment.

A total of 12 blower fans, driven by 15-hp., motors, are used in connection with the heating and ventilating equipment. The arrangement is such that all the motors are available for service the year around, the fans blowing air over radiators in the winter and through a cooler and washer in the summer. There are 13 exhaust fans throughout the station, driven by motors of from 6 to 20 hp., and one 5-hp. motor drives the water pump for the air-washing system.

The elevators are all plunger operated, using oil pressure instead of the usual water pressure. The oil pumps are driven by two 100-hp., General Electric slip-ring motors governed by a full automatic control system. Oil pressure is maintained at 850 lbs. per sq. in. in the working reservoir and at 55 lbs. per sq. in. in the supply system, the leakage oil being returned to the supply reservoir on the station roof by two upright, double-acting pumps geared to 3-hp.



Main Switchboard in Power Plant of the Kansas City Terminal.

Panelboards for Charging Electric Trucks Used in the Railway Station at Kansas City.

motors. Oil pressure is maintained when the pumps are idle by three plunger-type cumulators weighing 45 tons each. One of these cumulators is equipped with a contact-making mechanism which starts and stops the main pump motors as the demand for service rises or falls.

The station service is handled by a set of eight ejectors driven by Westinghouse 4-hp. vertical motors governed by full-automatic control equipment. Dumb waiters in the restaurant are operated by 5-hp. motors with push-button control. A total of 20 other small motors of 5 hp. or less are used in various services around the station and in the stands.

Telephones and Telautographs.

Three separate systems of automatic telephones, having a total of 319 instruments, are in service in and about the terminal station. The regular terminal system comprises 244 instruments, the Harvey system comprises 25 instruments, and 50 instruments are used in the gate system which connects up gates, towers, platforms and waiting room. The three systems, which handle an average of 18,000 calls every 24 hours, if manually operated, would require the service of 16 operators.

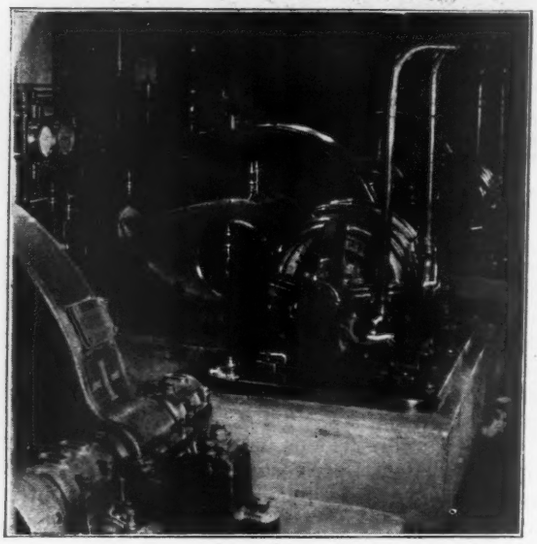
All train movements are recorded on a system of 44 recording telautographs located at various places in the terminal. These machines are actuated by four master machines located one in the west switch tower, one in the east switch tower and two in the telegraph office. The telautograph is particularly valuable in terminal operation work because of its automatic recording feature, making delivery of the message absolutely certain.

Electric Trucks and Tractors.

Four different types of tractors or trucks, having three kinds of battery equipment, are in service for hauling baggage, express and mail. The express tractors have 40-cell Edison storage-batteries and are used to haul trains of five to eight loaded trucks. Mail and baggage trucks are 11 ft. 6 in. long by 3 ft. 8 in. wide,

and are provided with 21-cell Edison storage batteries. Other trucks around the terminal, used for a variety of service, have 21 or 42-cell batteries.

The charging board for the trucks is arranged in two sections, one for the 21-cell units and one for the 40 and 41-cell units. Each section has four separate circuits, the 21-cell batteries being charged three in series on a single circuit and the larger batteries being charged singly. Cast-iron grid resistors, mounted on pipe supports back of the panels, are used to regulate the charging current. A



High-Pressure Elevator Pumps Driven by 100-Hp., Three-Phase Slip-Ring Motors.

single voltmeter and ammeter serve the entire set of charging circuits, the various readings being taken by means of a plug and receptacles. A totalizing ammeter is installed on each half of the charging board and the total charging energy is measured on the a-c. side of the charging motor-generators.

Special charging lines are run from the board to the roundhouse, coach yards and to a stub track at the east end of the station to serve a track runabout used by the terminal superintendent. All other charging lines are short, terminating at various places over the charging floor. The regular charging lines are distributed and supported on a set of steel wires suspended just below the ceiling, the conductors being supported directly on strain insulators.

TELLS ENGLISH OF PROGRESS IN TELEPHONY IN U. S.

Americans who are familiar with the extensive annual reports prepared by the Bell telephone system may find it interesting to know how they are regarded in England. The following digest, which was published in the London *Mail,* emphasizes points in the last annual report which make it an object lesson to its readers, the digest appearing under the significant heading of "Some Points for Mr. Illingworth."

There are over 12,500,000 telephone "stations" (instruments) in the United States; that is, one instrument to every eight people. In ten years the total number was doubled. This and other similarly interesting facts concerning the telephone service in the United States and its growth are contained in the annual report of the American Telephone & Telegraph Co., which has just been received.

A statistician would tell you how, if these instruments were placed a yard apart, they would reach from London to beyond San Francisco, and so on; but we must be content with passing on some of the phenomenal figures contained in this report.

There are approximately 11,000 telephone companies in the United States, all except about 1500 being connected with the Bell system, which, stated briefly, is the association of companies using the Bell patents. Connected with this system also are 26,000 rural lines and associations operated on a mutual or co-operative basis and not rated as companies. Other amazing statistics show that the average daily number of conversations is 30,000,000, that there are 9,500,000 miles of overhead wire and 14,500,000 miles of underground wire.

Mr. Illingworth, who stated in the House of Commons a few days ago that 103,000 new instruments had been installed in this country last year, will be interested to know that 730,000 were provided in the United States, a country with little more than twice the population of England.

This very efficient system, which provides a trunk (Americans call it "long distance") service that is the admiration of British visitors, maintains a department of development and research which during the past year "has actively prosecuted work upon more than 500 improvements in the telephone art." All these promise substantial advances in the character of the service or large economies in construction and operation. Mr. Illingworth should note.

A method of improving the grade of speech transmission has been perfected, and when the line is equipped by this new method it will be possible to carry on a conversation between New York and San Francisco (3919 miles) as clearly as at present between New York and Boston (235 miles).

Another fact of technical interest is that whereas cables placed as recently as 1916 contained circuits for long distance transmission having 320 lbs. of copper per mile of circuit, improvement has been effected to such an extent that even better transmission was given over circuits having only 80 lbs. of copper per mile—a consideration in these days of shortage and high price of metals.

All kinds of labor-saving devices are applied to construction. Pole-hole digging and pole-setting machinery mounted on and using power from motorlories is in service.

One pending development of the system is its extension to Cuba by means of cables to be laid from Key West to Havana, which will thus be brought into telephonic communication with all the principal cities of the United States.

AN AUTOMATIC TELEPHONE SYSTEM IN THE PATENT OFFICE.

There are many interferences in the functioning of the many delicate parts of an automatic telephone system. To aid in the solution of these problems, an automatic exchange system has been installed in the offices of the interference division of the United States Patent Office.

The system, which constitutes a complete exchange, comprises a 24-cell storage battery and charging machine, a switchboard, power-board, and ten desk-telephone sets. The switchboard is equipped with line switches of both the Keith plunger type with master switch and the later rotary type. There are also selector switches and connector switches so that the system illustrates the organization and apparatus of a standard exchange to accommodate 1000 subscribers. A ringing and busy-test machine is provided which is normally at rest, but which starts automatically whenever a call is made.

Development of National Water-Power Resources

Comprehensive Discussion and Compilation of Data Presented in Report of the Water-Power Development Committee of the National Electric Light Association at Its Recent Convention

The Water-Power Development Committee was appointed by the National Electric Light Association to investigate and report on the water-power possibilities of the country, both developed and undeveloped, and to suggest a broad policy for future development and interconnection of water-power systems. The committee is composed of Franklin T. Griffith, chairman, Portland (Ore.) Railway, Light & Power Co.; W. A. Brackenridge, Southern California Edison Co., Los Angeles; John A. Britton, Pacific Gas & Electric Co., San Francisco; H. T. Edgar, Mississippi River Power Co., Keokuk, Ia.; C. C. Egbert, Niagara Falls (N. Y.) Power Co.; Mortimer Fleischhacker, Great Western Power Co., San Francisco; H. I. Harriman, New England Power Co., Boston; D. L. Huntington, Washington Water Power Co., Spokane; H. F. Jackson, Sierra & San Francisco Power Co., San Francisco; Frank M. Kerr, Montana Power Co., Butte; W. S. Lee, Southern Power Co., Charlotte, N. C.; A. W. Leonard, Puget Sound Power & Light Co., Seattle; J. D. McKee, California-Oregon Power Co., San Francisco; G. W. Talbot, Pacific Power & Light Co.; Portland, Ore.; A. B. West, Southern Sierras Power Co., Riverside, Cal.; and A. G. Wishon, San Joaquin Light & Power Corp., Fresno, Cal.

The committee did not endeavor to touch upon the broad general fields of investigation undertaken by previous committees, but gave prominence to the conditions of water-power development prevalent west of the Rocky mountains. Leading engineers and executives of power companies throughout the country were consulted and considerable data was obtained by means of a questionnaire which brought out the legal and economic aspects of the situation.—EDITOR'S NOTE.

The imperative demand of a water-power development schedule embracing in large measure the great unused natural resources of the country is no longer doubted. Prominence is given in this report to the conditions of water-power development prevailing west of the Rocky mountains for the purpose of giving instances near at hand for verification rather than to set up for emphasis the individuality and peculiarities of water-power problems in the Far West.

Taking the 11 far western states as a specific example a careful survey shows that due to a delay of the construction program in power development while the nation was at war, this section of the country finds itself today facing a serious situation, ranging from an actual shortage of power to meet present demands, as in California, to an impending shortage to meet growing demands, as in Oregon and Washington. With increasing possibilities of coal shortage, the continual rise in price of oil and the economic desirability of early electrification of steam railroads, the urge for increased water-power developments in the Far West becomes imperative. Not only are many industries already existent dependent upon electrical development, but it is believed that industrial growth on the Pacific coast and electrical development are interdependent. This is true in agriculture as well as in industry. Vast areas of arid and semi-arid western lands have been converted into fertile districts by electrical pumping of water.

To a lesser degree the further development of the water power in the eastern states calls for the serious and earnest attention of utility operators and of the government itself. While the potential water powers of the eastern and central states can never be expected to meet more than a minor part of the present total power requirements of those states, which is approximately 96,000,000 hp., as against approximately 18,000,000 hp. of maximum potential water power possible of development in those states, the trend of labor and transportation conditions makes imperative the utmost co-ordinated development and application of hydroelectric power wherever available.

Much might also be said of this need in the eastern states purely from the standpoint of conservation of coal. Of the 542,000,000 tons of coal used in this country in 1915, approximately 267,000,000 tons were used for power purposes and 275,000,000 tons for heating. The efficiency at present obtainable for the latter use is approximately 50%, whereas for the former it approximates but 5%. It is therefore obvious that as far as possible the remaining coal supply of this country should be relieved of its power application and conserved for its more efficient heating application.

Although most desirable for the protection of future generations, it is, of course, not to be expected that water powers will be developed, at least in the near future, under conditions and in locations where an abundance of cheap coal or other fuel results in an economic advantage in favor of steam generation, but the time will no doubt come when the utmost development of all water powers will be enforced, if necessary, in the interests of conservation of fuel for heating purposes.

There are, however, at the present time numerous undeveloped water powers in the eastern states which can successfully compete with coal generation, and these undeveloped water powers are only awaiting favorable legislation to pave the way for their development.

NECESSITY FOR LEGISLATION.

An appendix to the report shows in considerable detail the personal opinions of representative central-station men throughout the country in regard to the need for suitable legislation and general economic conditions affecting water power. The general trend of the replies indicates the lack of suitable legislation and the need

for the establishment of a fixed policy on the part of the federal government in the granting of permits for development of water power on federal reserve lands and on navigable streams.

Existing federal legislation, as distinguished from state legislation insofar as it directly affects water-power development, relates to the use by power companies of navigable waters and of public lands and reservations. Federal enactments concerning navigable waters are of general application throughout the United States, and do not affect or interest one section of the country more than any other. Federal legislation governing the use of public lands and reservations, however, is of primary importance to the western states, in which lie nearly all the public lands and in which approximately 70% of the undeveloped water power of the nation is found.

Priority of Navigation Rights.

From the date of the Act of May 18, 1796, declaring that "All navigable rivers, within the territory occupied by the public lands, shall remain and be deemed public highways," down to the present time, Congress has guarded the rights of navigation, and it must be concluded that the right of the public to use streams for navigation is considered paramount.

By virtue of acts of March 3, 1899 and June 23, 1910, no dam in navigable waters may be constructed without consent of Congress and approval of the plans therefor by the Secretary of War and the Chief of Engineers, except that dams in waters, the navigable portions of which lie wholly within the limits of a single state, are permitted if authorized by state legislation and the location and plans are approved by the Chief of Engineers and the Secretary of War. The necessity of obtaining the consent of Congress in the one case and of a state legislature (if legislative authority of general character does not already exist) in the other, constitutes an obstacle which, if not insurmountable, at least operates to retard developments on navigable streams. The act to create a Federal Power Commission, now under consideration in Congress, would remove this obstacle by vesting in the commission the power to issue licenses for the construction of dams in navigable waters, the plans of the dam or other structure to be approved by the Chief of Engineres and the Secretary of War if the navigable capacity of the stream is affected by the project.

The existing act to regulate the construction of dams authorized the Chief of Engineers and the Secretary of War to impose conditions and stipulations deemed necessary by them to protect the government's interests, which may include the requirements of constructing locks, etc., without expense to the United States; of conveying to the United States free title to land needed for locks or other navigation structures when Congress authorizes the construction of the same in connection with the dam, and of granting to the United States free power for building and operating such structures. The Chief of Engineers and the Secretary of War are required, as part of such conditions and stipulations, to provide for improving and developing navigation, to fix such charges as may be sufficient to restore conditions with respect to navigability, or reimburse the United States for doing the same, and for further expense incurred by the United States, including cost of investigations necessary for approval of plans and of supervision of construction; to fix and collect just charges for the privilege granted to all dams constructed under the act which shall receive any direct benefit from (a) the construction, operation and maintenance by the United States of storage reservoirs at the head waters of any navigable streams or (b) from the acquisition, holding and maintenance of any forested watershed or lands located by the United States at the head waters of any navigable stream, wherever such shall be, for the development, improvement, or preservation of navigation in such streams in which such dams may be constructed.

The existing act also provides for forfeiture for noncompliance, after reasonable notice, with the act, stipulations, or conditions; also for revocation by Congress when necessary for public use, with payment of the reasonable value of the dam and works to be determined by agreement or by condemnation proceedings on failure to agree upon the value. The term of the permit is limited to 50 years.

The existing federal legislation as to power structures in navigable streams has not been subjected to the severe criticism directed against the government's policy in regard to developments on the public domain. But two answers to the questionnaire sent out suggested that federal control or regulation of navigable streams constituted an influence retarding the development of water powers.

Power Development on Public Lands.

Existing federal laws relating to power developments on public lands and reservations have unquestionably operated to hamper such enterprises. The creation of forest reserves and the executive withdrawal of power sites would not have deterred such projects if Congress had pursued a fair and liberal policy in recognition of the economic benefits resulting for such developments. The acts of Congress, however, provided no definite term of use, were meager in detail, and left too much to departmental regulations, with the result that financial support of meritorious projects could not be secured. The lack of certainty of tenure, the imposition of excessive rental charges, the regulation of rates for service, the possibility of cancellation of the permits, the cumbersome procedure, the lack of authority of local officials, unreasonable delays in obtaining rulings and action, absence of centralization of authority—it being necessary in some instances to deal with with the Department of the Interior and the Department of Agriculture—and the injustice of the regulations when a minor part of the project was on public lands, all tended to make a development on the public domain unattractive to both investors and operators, especially if at all in actual or potential competition with other power companies owning their plants in fee simple.

A policy no doubt intended to work for conservation actually resulted in waste and irre-

trievable loss to the extent of the consumption of coal and oil which might have been avoided by the use of water. Ideas concerning conservation are not now so hysterical and there appears to be a better understanding of the needs of power companies and the conditions under which developments may be made on public lands, and a clear recognition of the economic necessity of making such developments and the economic good resulting to the general public from them, with the prospect of soon receiving from Congress legislation which will be more liberal. The fear of many well-meaning persons that water powers on the public domain would be developed by grasping capitalists for the purpose of exploiting a defenseless public is now almost entirely dispelled by the general appreciation of the power of public service commissions to regulate rates justly.

State Laws of Navigable Streams.

State laws relating to the construction of dams in navigable waters controlled by the state and to the use or acquisition of lands needed for the construction of power plants and of transmission lines seem to be generally satisfactory. In Pennsylvania, however, power companies are embarrassed by not having the power to appropriate property (eminent domain) necessary for transmission and distribution lines. In New York, where the economical development of power possibilities cannot be carried out without regulation of flow by reservoirs, it appears that under the present constitution of that state such lands cannot be acquired by condemnation. The larger portion of undeveloped power in New York is in, or connected with, state forest reserves which cannot be entered for practical purposes without a change in the state constitution.

The right to use or appropriate the waters of any stream, whether navigable or not, depends upon the law of the state wherein the stream is located. Congress has never assumed to regulate the use of water except as navigation is affected, providing in the right-of-way acts that waters shall remain governed by state law. In the Forest Service Act of June 4, 1897, it is declared that "all waters of such reservations may be used for domestic mining, milling or irrigation purposes, under the laws of the states wherein such forest reservations are situated, or under the laws of the United States and the rules and regulations established thereunder." The Forest Service has not attempted to avail itself of this last clause, but takes the position, as yet, that the states shall control the waters. Control of access to streams, however, would seem in fact to be control of the waters of the stream.

We find that in the exercise of the power of each state, by constitutional provision, by legislative enactment, or by court decision, to adopt such a rule governing the waters flowing or standing therein as it sees fit, the various states as to their water laws may be grouped as follows:

(1) Those which have adopted the common law of riparian rights only, as has been done in the eastern states.

(2) Those which have rejected the common law of riparian rights and adopted the arid region doctrine of appropriation. This is known as the Colorado doctrine and is in force in Alaska, Arizona, Colorado, Idaho, New Mexico, Nevada, Utah and Wyoming, and partially in Nebraska, Oregon, Texas and Washington.

(3) Those which have retained the common law of riparian rights and at the same time adopted the arid region doctrine of appropriation, thus having a dual system. This is known as the California doctrine, and is in force in California, Kansas, Montana, North Dakota, Oklahoma, South Dakota, and partially in Nebraska, Oregon, Texas and Washington.

A number of states have adopted extensive water codes based on the law of appropriation but recognizing vested rights, whether riparian or otherwise. These states number Colorado, California, Idaho, Nebraska, Nevada, New Mexica, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Wyoming and Washington.

These states have constitutional or legislative declarations that unappropriated waters are "the property of the state," or "the property of the public," terms held synonymous, in the making of which the state acts in its sovereign capacity and not as proprietor or owner of the waters.

Influences Retarding Hydroelectric Development.

The questionnaire answers show, in the main, reasonable satisfaction with existing state laws. In California the combined system of riparian rights and appropriation is found embarrassing. In that state storage is necessary, and this results in bringing the water to the riparian owner in different quantities and at other times than it would come in the course of nature, necessitating the obtaining of consent agreements from riparian owners. The doctrine of riparian rights is protected by the constitution and cannot be abolished by the legislature.

The answers received to the question, "What influences are retarding the development of water powers in your state?" may be summarized as follows:

(1) Influences of a physical character:
  (a) Variable stream flow or lack of continuous supply: Ind., Kan., Penn., Dist. of Col.
  (b) Low heads: Neb., Penn.
  (c) Lack of impoundage: Penn.
  (d) Climatic conditions, such as drought and freezing: Ind., Neb.

(2) Influences of an economic character:
  (a) Cheap fuel: Ind., Kan., Penn.
  (b) Market conditions: Md., Nev., Wash., Ark., Ky.
  (c) Cost of money: Ga., Ind., Ky.
  (d) High cost of development: Md.
  (e) High cost of lands overflowed: Iowa.
  (f) Refusal of investors to finance developments under unattractive terms of government permit: Col.

(3) Influences of public policy:
  (a) Tendency of regulatory commissions to keep down service rates: Ga.
  (b) Municipal competition: Wash.
  (c) Conservation policies: Cal.

(4) Influences of legislation or lack thereof:
  (a) Inertia of Congress: Cal:
  (b) Government withdrawals: Mont.
  (c) Lack of right of eminent domain: N. Y., Penn.
  (d) Embarrassment resulting from doctrine of riparian rights: Cal.
  (e) Lack of co-operation between states as to interstate streams, especially in relation to the construction in one state of reservoirs which benefit water users in another state: Mass.
  (f) Restrictions as to use of waters of international boundary streams: N. Y.
  (g) Restrictions as to entry on state forest reserves: N. Y.

In answer to the question, "What, if any,

legislation should be enacted to make available for development the water powers of your state?" replies received from practically every western state specified the passage of the water power bill now pending before Congress. The retarding influences above summarized indicate the character of desired or needed legislation in the different states from which answers were received.

Pending National Water-Power Legislation.

The most important national legislation to be expected in the near future affecting water power developments is the final passage of the so-called "Water Power Bill," which was first passed by the House, later amended and passed by the Senate in its amended form, and which is, at the time of writing this report, in the hands of a joint conference committee with prospects of an early passage.

This bill is the final result of over ten years of controversy and exhaustive hearings and discussions before various committees of Congress in an endeavor to provide a law establishing the conditions under which, and the necessary administrative machinery by which, the water-power resources of the country might be developed under terms sufficiently attractive to capital and yet properly safeguarding the public interests.

Briefly the essential features of this bill, as amended by the Senate, provide for (1) the creation of a federal power commission, consisting of the Secretary of War, Secretary of the Interior, and Secretary of Agriculture; (2) the detailing of an officer of the U. S. Engineering Corps to serve the commission as executive secretary and engineer; (3) investigations by the commission to collect and record data in regard to water resources of the country, water-power surveys, industries requiring power, etc.; (4) the commission is authorized to issue licenses not exceeding a term of 50 years, the development to be subject to purchase by the government at the end of that period, with due regard given to severance damages; (5) provision is made for the payment of permit fees annually by the holders of the permits, such fees to be of sufficient amount to cover the administrative expenses, but in no case to exceed 25 cents per horsepower; (6) the establishment of rules and regulations governing the conditions under which the act is to be administered by the commission; (7) provision is made that the rates and conditions of service of public utility companies operating under permits provided for in this act, are to continue under the jurisdiction of the state public service commission, or in the absence of such a commission, to be applied under the jurisdiction of the Federal Power Commission.

While this bill is perhaps not all that might be desired, it will no doubt furnish a sufficiently practical and acceptable basis for the early promotion of various projects now awaiting such legislation.

Committee on Water Power Suggested.

The utmost co-operation between the Federal Power Commission to be established and the electric power industry should be inaugurated and encouraged. Particularly does this apply in the formulation and application of the rules and regulations to be established by the commission in accordance with the act. On these rules and regulations and on their interpretation and application will depend to a large extent the ultimate success or failure of the purpose of the act, which is the development of the country's water-power resources.

It is essential that the electrical industry act as a unit in co-operation with the commission, and, as a means to that end, it is proposed and recommend to the National Electric Light Association that a permanent committee be appointed to represent the industry in its relations as a whole with the Federal Power Commission.

The work of this committee, if carried along the lines here contemplated, should be of inestimable value not only to the industry but to the Federal Power Commission and to the country at large. It is earnestly hoped, and confidently expected, that the commission will be receptive to such co-operation on the part of the electrical industry and will welcome suggestions and recommendations from men, the broad experience of whom in the financial and engineering phases of water-power development, will be of great value to the commission in the development and application of rules and regulations which will be practical and workable as well as sufficiently adequate to meet the restrictions contemplated by the act.

TABLE 1—WATER POWER OF UNITED STATES.
From U. S. Geological Survey Estimate of 1915.

	Potential maximum.		Developed		
	Hp.	Per cent of total potential of U. S.	Hp.	Per cent of total developed of U. S.	Per cent of max. potential of district.
Western states ..	42,850,000	67.5	2,560,000	29.7	6.0
New England states	1,921,000	3.0	1,441,000	16.7	75.0
Atlantic states ...	10,922,000	17.2	3,019,000	35.0	27.7
Central states ...	7,797,000	12.3	1,589,000	18.6	20.4
Total U. S.....	63,490,000	100.0	8,609,000	100.0	12.7

TABLE 2—WATER POWER OF WESTERN STATES.
From U. S. Geological Survey Estimate of 1915.

	Potential maximum.		Developed		
	Hp.	Per cent of total potential of U. S.	Hp.	Per cent of total developed of U. S.	Per cent of max. potential of state.
California	9,250,000	14.6	910,000	10.6	9.8
Oregon	7,000,000	11.0	280,000	3.2	4.0
Washington	9,500,000	15.0	570,000	6.6	6.0
Arizona	2,000,000	3.1	34,000	0.4	1.7
Colorado	2,000,000	3.1	190,000	2.2	9.5
Idaho	6,000,000	9.4	160,000	1.9	2.7
Montana	4,500,000	7.1	250,000	2.9	5.6
Nevada	250,000	0.4	33,000	0.4	13.2
New Mexico	300,000	0.5	3,000	...	1.0
Utah	1,250,000	2.0	125,000	1.5	10.0
Wyoming	800,000	1.3	5,000	...	0.6
Total western states	42,850,000	67.5	2,560,000	29.7	6.0
Total U. S.	63,490,000	100.0	8,609,000	100.0	12.7

Present and Potential Water Powers.

The present and potential water powers of the United States have been estimated at various times during the past 12 years. In the report of the United States Geological Survey of 1908

the data set forth form the basis for a number of subsequent reports on the subject. Explanation is given in considerable detail of the methods by which the estimates of potential and developed water power were made and the figures given, with the more recent adjustments, and additions made thereto, are the most authoritative data available at the present time. In giving consideration to these figures, it must be borne in mind that calculations on potential water power are essentially approximations only, since the ultimate development of any water-power project is dependent on a large number of factors such as possible storage development and practical availability of overflow lands, which is impossible of accurate determination in such a preliminary survey and estimate. Even the data on developed water power must necessarily be estimated to some extent, although the Bureau of the Census has from time to time compiled statistics on developed water power, which are so complete as to leave little margin requiring determination by estimate.

For the purpose of analyzing the general power situation, however, the estimates of developed and potential water power, which have been made, are fully sufficient and adequate.

Comparative Water-Power Development.

In an examination of this tabulation attention is first attracted to the fact that 68% of the potential maximum water power of the United States lies in the western states (California, Oregon, Washington, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming). In connection with these percentages it is also of interest to note that of the total maximum potential water power of the United States, 73.3% represents undeveloped power coming under federal jurisdiction, i. e., lying on federal reserve lands or on navigable streams wherein federal permits are required. In the western states 94% of the maximum potential water power is in this class. These percentages are from "Facts About Water Power" prepared and published by the executive committee of the Water Power Development Association. In other words, practically all of the future developments of water power in the western states (covering approximately 70% of the total potential water power of the country) will be dependent upon federal action in the matter of issuance of workable permits for the development of these projects.

It is also of considerable interest and significance to note that, in the United States as a whole, only 16.6% of the maximum potential water power has been developed up to the present time. For the western states alone this proportion is only 6%. In other words, the maximum potential water power of this country has, to date, been developed only to the extent of one-sixth of the total possible, and, in the case of the western states, only about one-sixteenth of the possible water power has been utilized.

While it is true that the figures here given for potential maximum water power include water powers which are not at the present time within the range of economic development, it is also true that these figures do not include the additional water power which would be made available at some of the power sites by the development of seasonal storage reservoirs. This latter feature of water-power development is a factor which is not susceptible of a definite estimate from the data at present available. The values here shown for potential maximum power represent values of six months' continuous power, i. e., the minimum power available for the maximum six months' flow during the cycle of a year, without consideration of the possibilities of seasonal storage reservoirs.

The Factor of Seasonal Storage.

While, as previously stated, no definite estimate can be made of the total additional water power which might be made available by the inclusion of seasonal storage, some idea can be obtained of the effect of such storage on the total potential water power available. It has been roughly approximated, from the limited data available, that something like 200,000,000 hp. would represent the possible maximum potential horsepower with maximum storage facilities developed and utilized, as compared with approximately 60,000,000 hp. which, in the tabulation, is considered as the potential maximum horsepower available.

In the case of the central and eastern states, particularly the New England states, it is shown that a comparatively large portion of the potential water horsepower has been already developed. In the case of the New England states the high percentage of 75% already developed shows that little additional water-power development is to be expected in this district. Future developments will consist chiefly in the more efficient utilization of the water powers already developed. Such increase in efficiency will be accomplished largely by co-ordination and unification into a comprehensive system of the numerous small developments which have been established there for a number of years.

Inasmuch as the western states represent such a very large proportion of the potential maximum water power of the country, interest is naturally directed to this group. Table 2 shows in detail by states the potential maximum horsepower and the developed horsepower of this group.

Water-Power Developments in Western States Compared.

Particular attention is directed to the latter. California is shown well in the lead with a present development of 910,000 hp., which is 10% of the entire developed water power of the United States. It is, however, only 10% of the maximum potential water-power possibilities of that state. While Washington shows the largest maximum potential water power of any state, it ranks among the western states below both California and Montana in the amount of developed water power, showing only a development of but 6% of its potential maximum possibilities and only 6.6% of the total developed water power of the country. Oregon also shows wonderful potential water-power possibilities and low percentage of development. These figures clearly show that, although the West has already developed some remarkable water-power projects and is well up in the lead in the development of

large interconnecting networks of transmission systems, the water-power development in this section is however but begun.

A map of existing western transmission lines, with a realization of the territory covered, gives a conception of the great distances involved in western transmission. Interconnections between systems have completed the circuit until there is now an unbroken connection from Medford, Ore., on the north, down to Los Angeles on the south, thence to the Mexican border line, and from Los Angeles on northward into Nevada—an extent of over 1400 mi. The interconnection in the Northwest that exists in the operation of the Chicago, Milwaukee & St. Paul railway, which is now electrified over the Cascade and Rocky mountains, gives another instance of long-distance interconnected service. This railroad, from Harlowtown, Mont., to Seattle, will make a solid chain of copper of some 803 mi., when the remaining power interconnection of 150 mi. in Washington is completed during the forthcoming summer.

Transmission Lines in the West.

The networks of transmission lines usually cluster about some great city or industrial center. Thus we have the power lines of the Southern California Edison Co. coming down to Los Angeles from Big Creek, a distance of 240 mi., together with a number of other high-powered lines which come into Los Angeles from various distances. The area served by this one company is so vast that were it superimposed upon the 240 operating companies in New England, this one company would outdo them in extent of area served. On to the north the district in and about San Francisco constitutes another interesting phase of development wherein will be found even greater areas served than that by the Edison company. Here the Pacific Gas & Electric Co. and the Great Western Power Co. combine in an unusually large system. In fact, during the war period, this interconnected system with the Sierra & San Francisco Power Co., comprising the three companies then serving San Francisco, which as a war measure were placed under one operating management, had the greatest power output ever recorded in the United States up to that time. The statistics from April 1, 1917, to March 31, 1918, are as follows:

	Kw-hrs.
Pacific Gas & Electric Co. Great Western Power Co. Sierra & San Francisco Power Co.	1,500,408,765
Commonwealth Edison Co.	1,488,080,000
Niagara Falls Power Co.	1,188,221,770
Ontario Power Company & United Electric Light & Power Co.	954,913,584
Montana Power Co.	947,732,014
Montreal Light, Heat & Power Co.	946,832,817
Hyraulic Power Co.	871,563,138
Toronto Power Co.	800,638,000
Southern California Edison Co.	794,687,405

Farther up to the north and east, about Portland, Seattle, Spokane, Butte, Boise and Salt Lake City, are to be found similar high-tension networks and vast distribution systems of hydroelectric energy serving in the development of agricultural empires and industrial centers in the embryo.

In any discussion wherein actual development of western water power is to be considered, it must not be overlooked that the topography of this region frequently necessitates the solution of problems unprecedented in engineering practice.

Water-power development in the West, in the main, has not followed the popular conception of such enterprise. The general conception of a power project involves the harnessing of a waterfall, such as Niagara, or of lesser magnitude, as the case may be. The typical western development usually involves no waterfall of any size. The power project is located in a mountain canyon where either a reliable minimum flow of the stream may be found the year round, or else storage is developed, above the point of such diversion. Such a power site may not require a waterfall at all, but merely rapids in a stream. The water is diverted by a ditch, flume or tunnel and conducted around the mountain side at a less grade than that of the stream. When this is continued for many miles it is evident that a difference in level will occur between the water in the ditch and that in the natural run of the stream. As a consequence at the end of 2 to 15 mi. of ditch, flume or tunnel, a drop of from 100 to 2500 ft. may be developed. Such artificially created waterfalls are more typical of western development than is the utilization of a natural waterfall.

The mountainous situation of these developments, the tremendous heads which it has been possible to develop and the great distances involved in the transmission of power to the centers of population have demanded both originality and daring in the engineers who have been called upon to meet the problems, with the result that precedent has often been disregarded and history written along many lines of engineering achievement.

Steam is, of course, used throughout the western region for stand-by purposes and in some sections of the West it still proves the more economical source of power. Taking the district as a whole, however, hydroelectric far exceeds steam generated power, the proportion being about 75% hydroelectric to 25% steam. It is nevertheless of importance to point out the predominance of fuel oil as a fuel in the southwest region and California, as well as to call attention to such economy records as that made by the Arizona Power Co., where a record of 333 kw-hrs. per barrel of oil is said to have been obtained. With the program of construction in the development of water power now under way, and planned for the coming ten years, however, steam generation will become a still more minor factor in the electric service of the West, except for stand-by purposes.

PLAN HYDROELECTRIC DEVELOPMENT FOR THE DEAD SEA.

A plan to utilize the difference in level between the Mediterranean and the Dead Sea for the development of hydroelectric power has recently been brought forward. A tunnel 37 mi. long from the Dead Sea valley would give a drop of 1295 ft. for power generation. The power would be used for lighting and industrial purposes in the Holy Land, and to pump water from Lake Genezareth to irrigate the Jordan valley and the plain of Sharon. It is claimed that with regulating dams there is enough water to irrigate several thousand acres.

Steel Transmission Line Towers

Considerations in Selection of Towers for Different Sections of a Transmission Line—Methods of Anchoring—Assembly and Erection — Trend of Practice in the Spacing of Towers

By E. L. GEMMILL

Chief Engineer, Transmission Tower Department, Blaw-Knox Co., Pittsburgh.

This is the concluding article of a series by Mr. Gemmill on the subject of steel supports for transmission lines, the preceding articles dealing with modern engineering practice in connection with loading and wind pressure on transmission towers and lines, theory of suspended wires, relations existing between stress, temperature and sag in transmission lines, and a discussion on spacing of conductors and specifications for the design of towers.—EDITOR'S NOTE.

The average line of any length should have three different types of towers. These may be designated as "standard or straight-line," "anchor" and "dead-end" towers.

All towers should be designed to take care of the dead weight of the structures and also the vertical loads at the ends of all the crossarms, in addition to and simultaneously with the horizontal loadings specified below.

Standard or straight-line towers should predominate, and should be designed to support without failure the required horizontal loads transverse to the direction of the line, combined with a horizontal pull in the direction of the line applied at any one insulator connection equivalent to the value of the wire when stressed to about one-half its ultimate strength. These loads transverse to the line should be large enough to include the wind load across the wires and that against the tower itself, with a margin of safety.

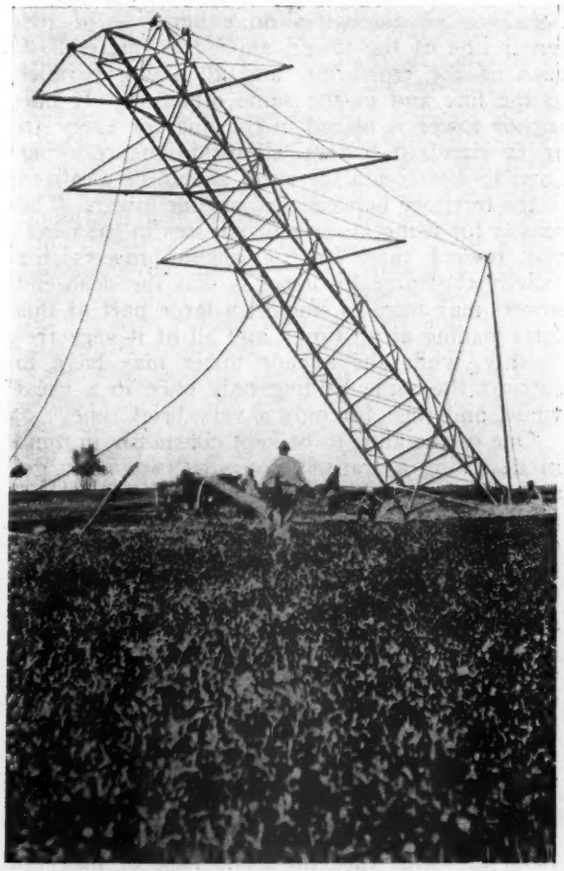
ANCHOR TOWERS.

The anchor tower should be designed to support without failure any one of the following horizontal loadings:

(1) The same horizontal loads as those specified for the standard tower.

(2) An unbalanced horizontal pull in the direction of the line equivalent to the *working loads* of all the conductor wires and the ground

View Showing How Rigid Steel Towers Are Erected in Position.



Method of Erecting Flexible "A" Frame From Prone Position.

wires, applied at the points of connection of the wires to the tower, combined with the transverse horizontal loads on the wires and the tower.

(3) An unbalanced horizontal pull parallel to the line equivalent to the *working loads* of the wires, applied at one end of each crossarm, all on the same side of the tower and all acting in the same direction, combined with the horizontal transverse loads on the wires and the tower.

Dead-End Towers.

The dead-end towers should be designed to support the same loadings as those specified for the anchor towers, but the sections should be determined by using smaller unit stresses. Unit stresses of 18,000 lbs. per sq. in. in tension and $18{,}000 - 60\,L/R$ for compression would give these towers approximately 50% more strength than the anchor towers would have when stressed just within the elastic limit.

It will be noted that under the above specification the standard tower will be required to take care of the torque resulting from an unbalanced horizontal pull equivalent to the *allowable tension* (which is one-half the ultimate strength) of one wire, applied at one end of any crossarm and acting parallel to the direction of the line while the anchor and the dead-end towers are both required to take care of either the torque, as given above for the standard tower, or the torque resulting from an unbalanced horizontal pull equivalent to the *working loads* (actual tension in the wire under the working conditions) of all the wires on either side of the center line of the tower, applied at one end of each of the crossarms, and all acting parallel to the line and in the same direction. If one anchor tower is placed in the line for every 10 or 12 standard towers, all conditions resulting from broken conductor wires should be localized to the territory between two anchor towers. The reason for using lower unit stresses in the dead-end towers than in the anchor towers for exactly the same loadings, is that the dead-end towers may have to support a large part of this total loading at all times, and all of it very frequently, while the anchor tower may have to support the same loading only once in a great while, and then for only a very brief time.

One of the aims to be kept constantly in mind in designing a transmission structure is to get a finished tower in which all the stresses can be determined definitely. This is usually done graphically. The stresses resulting from the horizontal loads applied as so much shear must be determined separately from the stresses resulting from torque. These stress diagrams cannot be combined except in those cases where the slope of the post does not change between the horizontal planes bounding that part of the tower for which the diagrams are wanted. This is true because the horizontal loads which act as so much shear may be assumed to be acting in a plane containing both posts of the face of the tower, parallel to the direction of the load, in which case the posts may or may not (depending upon the slope of the posts) take up a part of this shear directly. On the other hand, the torque is a moment acting in a horizontal plane and is constant between any two parallel planes unless it is either increased or decreased by an additional torque of the same or opposite kind.

Anchorage Designs.

The members for anchoring the structure to the footings are generally the last part of the design to be considered.

The first question to be determined is whether concrete footings shall be used. These are more simple and involve much less steel work than any other type of footing used for transmission line structures. The weight of the concrete itself reacts against the tendency of the post to pull away from the base because of the tension in the post on one side of the tower. It also offers more bearing surface against the earth around the footings and introduces the passive resistance of a larger volume of earth against the uplifting tendency of the post on the tension side of the tower. Of course, the saving in the cost of steel in the structure must be balanced against the expense involved in putting the concrete in place, to determine whether or not it is advisable to use concrete footings. This will depend upon many circumstances which must be very carefully considered before reaching a conclusion.

It is impossible to over-estimate the importance of good anchorages. An otherwise excellent construction may be made inadequate by using footings which are not substantial. If one of the footings should be insufficient to take care of the loads for which the superstructure is intended it would be very apt to yield under full loading, and in doing so would bring about a new distribution of stresses among the members, and would put on some of the members stresses which were not in keeping with those for which the members were designed. Such a rearrangement of stresses may very easily be so vital as to bring about the failure of the superstructure. In view of this fact it is recommended that, where there is any doubt as to whether concrete footings should be used, the benefit of any small doubt should always be given in favor of such footings. But it may be that the structures are to be used where such footings would be practically impossible. Under such circumstances other provisions must, of course, be made.

In the case of poles the regular outline is generally continued below the surface of the ground whether concrete footings are used or not. If concrete is not used then additional steel must almost always be used to get more bearing area against the earth.

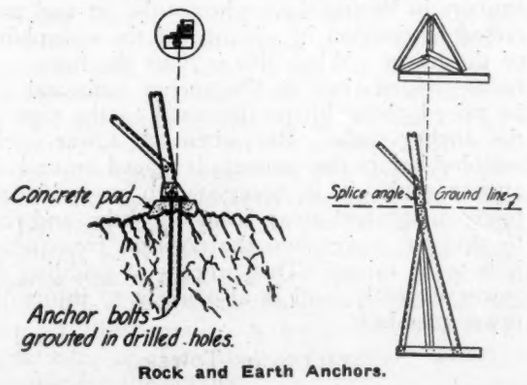
In the case of towers there is provided a separate footing for each of the posts. When concrete footings are used the posts are connected to them in one of two ways. In the first method, extensions of the post sections, which are called anchor stubs, may be built in these footings with just sufficient length extending above the concrete so that the lower post sections of the tower may be connected directly to them. These anchor stubs may extend almost to the bottom of the footing, or they may extend into the footings only far enough so that the adhesion of the concrete to

them will develop their full strength, in which case it will be necessary to add steel reinforcing bars from this point to the bottom of the concrete. This is necessary because provision must be made to bind the concrete together so that it will not break apart under the uplifting force in the post and thus defeat its purpose. The other method used with the concrete footing is to have a base at the lower end of the post section which will bear directly on the mass of concrete in the footing, and which will at the same time be connected directly to this concrete by means of long bolts or rods extending well into the mass of concrete. These rods, in this case, would be brought into action only when the post is under tension. If these rods are straight for their full length, and fairly large, they should be imbedded in the concrete for a length equal to 50 times their diameter, in order to develop their full breaking strength. But if these rods are bent a little near their lower ends their breaking strength will be developed by imbedding them in the concrete for a length equal to 40 times their diameter. Provision for binding together the concrete in the footing must be made when anchor rods are employed, just the same as when anchor stubs are used.

With any type of footing there must be provided sufficient bearing surface against the earth to resist the maximum compression in the post, and also an arrangement to lift enough earth to resist the maximum uplifting tendency in the post under the worst condition of loading.

The most positive and direct way to determine the size and outline of a footing for any given loading is to increase this loading by the desired factor of safety, and then to determine a footing of which the ultimate resisting value will be sufficient to meet the conditions to be imposed. It is recommended that the footing be so designed that its ultimate resisting value will be not less than 25% in excess of what is necessary to sustain the loading specified for the pole or tower.

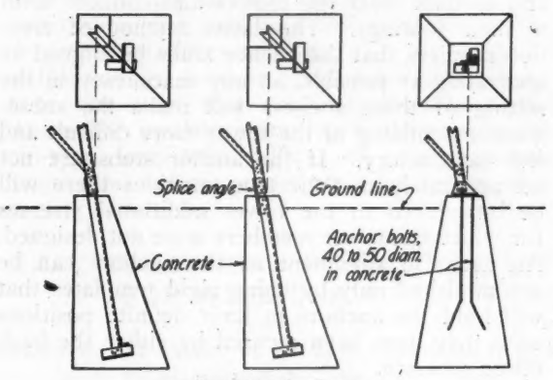
For specially heavy towers which are required



Rock and Earth Anchors.

to dead-end heavy wires on long spans, it sometimes becomes a troublesome matter to provide adequate footings to take care of the uplift from the posts on the tension side of the tower under the assumed condition of maximum loading. This often happens in the case of river-crossing towers. Footings for such cases, if built in the ordinary way, would have to be made very deep and would require a large amount of concrete. It will often be found to be economical to design these footings with special outline and construction.

The following rather unique method has been successfully employed for taking care of cases involving unusually large uplifts, when the footings are built in clay or in mixed clay and



Concrete Anchors.

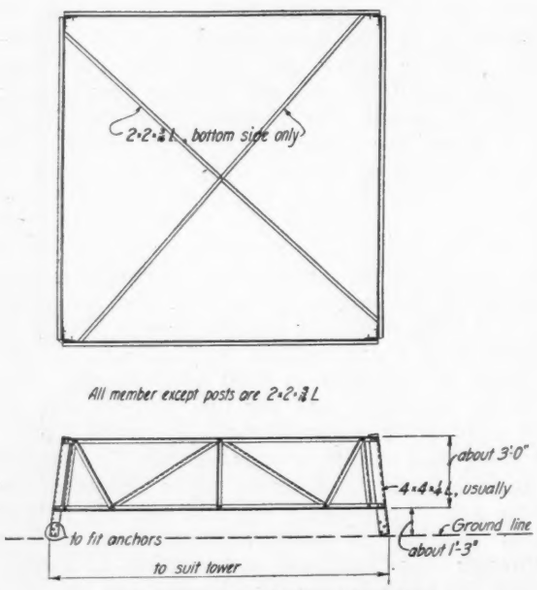
sand that is comparatively free of gravel. A square pit is dug deep enough so that its bottom will be below the frost line and large enough to afford sufficient bearing area against earth to sustain any possible downward pressure where the tower post may be subjected to either tension or compression. In the center of this pit a hole about 20 ins. in diameter is bored with an earth auger to the depth desired (this depth has been made as much as 20 ft. below the bottom of the square pit). Dynamite is then placed in the bottom of this hole and connected with a firing magneto; then the hole is filled with concrete of 1:2:4 mixture, medium wet, and the charge of dynamite is fired immediately. The charge generally used for this purpose consists of eight ½-lb. sticks of 60% dynamite. Reinforcing bars with their ends bent are then pushed down through the concrete to the bottom of the hole and then raised 3 ins. and securely held in this position to prevent them from sinking through the concrete and coming in contact with the earth before the concrete has set. The hole is then refilled with concrete and the footing in the square pit is also poured and finished. From the moment the dynamite is placed and connected with the firing magneto it is essential that all the subsequent operations be conducted as rapidly as possible. Not more than five minutes should be allowed between the time when the first pouring of concrete is started and when the dynamite is fired.

The average displacement from such an explosion of dynamite is about 1.5 cu. yds., this, of course, being dependent upon the depth of the hole and the nature of the surrounding earth. Experimental footings placed in this manner show that the enlarged base takes an almost spherical form with its center above the bottom of the excavated hole a distance equal to about one-fourth the horizontal diameter of the enlarged base. This diameter is sometimes almost 4 ft. It is evident that a footing of this kind can be made to resist a large uplifting pull.

In the case of light towers it is sometimes considered advisable to put the tower in its erect position above the ground before the anchors are set, and to then bolt these footing members

to the lower end of the main tower legs and put concrete or earth back fill around them while the tower is being supported independent of them. But in the case of heavy towers it is generally considered more economical to set the footing members exactly in their position first, and to then erect the towers and connect them to their footings. This latter method of erection requires that the anchor stubs be aligned as accurately as possible, as any inaccuracy in the setting of these anchors will make the subsequent assembling of the tower more difficult and less satisfactory. If the anchor stubs are not set accurately to their true positions there will be introduced in the tower additional stresses for which the tower members were not designed. An accurate alignment of the anchors can be accomplished only by using rigid templates that will hold the anchors in their definite positions until they have been secured by either the back fill or concrete.

Almost all towers are built smaller at the top



Template for Setting Anchors.

than at the ground line, and the tower leg inclines from the vertical as determined by this outline of the structure. The anchor stub generally follows the direction of the main tower leg, but when it is put in this position and suspended from a template it has a tendency to swing to the vertical position. To obviate this condition the setting template should be trussed as shown in the illustration above.

Erection of Towers.

Transmission towers are erected in one of two ways. They may be erected by assembling the members one at a time in their proper positions in the completed structure, or by assembling the complete structure in a prone position, and raising it to its vertical position by swinging it about two hinge points on or near two anchor stubs.

If the first of these two methods is used, there will generally be required a crew of eight men, including one foreman. The following equipment will generally suffice: One light gin-pole, about 25 ft. long; one set of two-sheave and three-sheave blocks for ¾-in. diameter rope; about 300 ft. of ¾-in. diameter rope; four hand lines, each about 150 ft. long; four small gate blocks for the hand lines.

The post members are erected with the gin-pole and tackle, but all the other members are pulled up from the ground with the hand lines. The time required will be about the same whether the tower is light or heavy. It will, however, depend upon both the accuracy of the fabrication of the material and the accuracy of the alignment of the anchor stubs.

If the second method is used, the actual work erecting the tower does not consume more than 10 or 15 minutes after all the preparations have been made. These preparations and the erection consist of three distinct operations:

(1) Leveling the ground where required for the erection equipment, and blocking up the tower on rough ground and for side-hill extensions. A crew of seven or nine men, including a foreman, is required.

(2) Rigging up erection equipment and bolting erection shoes and struts in place, etc. A crew of about 12 men, including a foreman, is required.

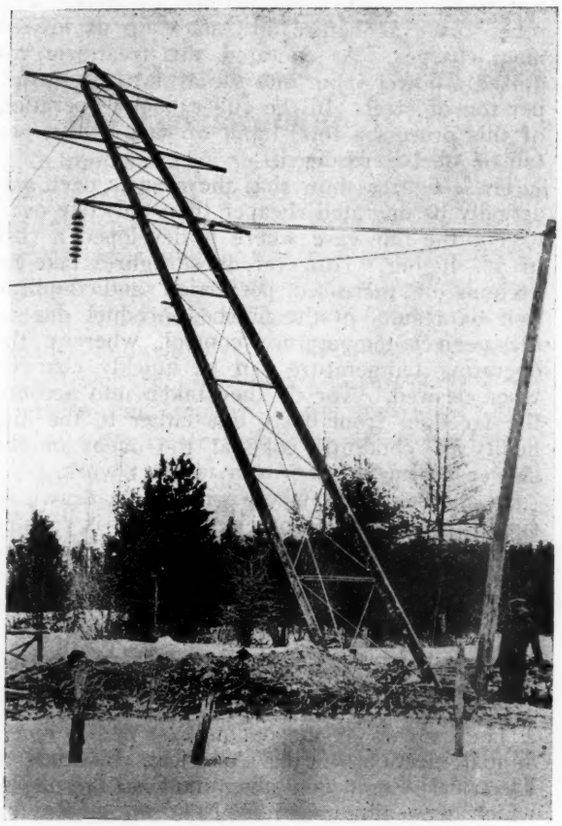
(3) The actual raising of the tower. Sometimes horses are used for this operation, but it is often found to be more satisfactory to use a caterpillar tractor, especially for raising the heavier towers. One team of horses will generally suffice for this work, but it often requires four and sometimes six horses, especially in rough country and for raising towers that are unusually heavy. The tractor gives a much steadier pull and will permit of holding the load at any desired point more satisfactorily than when horses are used. A substantial A-frame usually built up of steel pipes is generally employed for raising the tower from the prone to the upright position. A steel cable should also be used in preference to a manila rope for this purpose in the case of the heavier towers.

When concrete footings are used and this method of erection is employed there is an advantage in having the anchor stubs set and concreted in position in advance of the assembling of the tower. When this is done the tower can be assembled close to the anchor stub and can be raised about hinges fastened to the tops of the anchor stubs. But when the tower is assembled before the concrete is placed around the anchor stubs it is necessary to assemble the tower a few feet away from the stubs, and then to skid the tower into the position from which it is to be raised. This process of skidding the tower is costly, and is also likely to injure the tower members.

Spacing of Towers.

The trend of American practice today in the designing of transmission line installations is to make the spans between supporting structures as great as possible. As the result of considerable study, extending over several years of experience with lines having spans some of which were very short while others were exceptionally long, it has been determined that the best and most economical lines, all things considered, are those in which the supporting structures are spaced far apart.

This is true even though the first investment for the original installation is somewhat larger in the case of long spans than where short spans are used. It has been determined from com-



Erecting a Flexible "A" Frame for Double-Circuit 66,000-Volt Line.

parative records that the maintenance of lines having the long spans is much less than was the maintenance of the same lines during previous periods when shorter spans were used. This decreased cost of maintenance has been proved to be sufficiently important to warrant making larger initial investment on original projects. The maintenance is not only less expensive with the long spans but it is also less troublesome, because there is less interference with continuous service along the line. This is a matter worthy of careful consideration, as the value of electric service in almost every case is dependent upon the assurance of its continuity.

By using long spans the number of insulators required is reduced; and, as there is always a chance that a flash-over will occur at the insulator, it is obviously advisable to reduce the number of insulators to a minimum in order to eliminate, as far as possible, this source of trouble for the service.

Another advantage derived from the use of long spans is that the variations of stress in the wires resulting from large changes in temperature will be much less than under similar conditions of loading on short spans. The constant changing of stress in the wires is productive of more trouble than higher stresses which are more uniformly applied.

The long span is especially advantageous for a line carried along a hillside, because it will generally permit of such an arrangement of towers that there will not be any upward pull on any of them. The upward pulls are always a source of trouble, and they should be eliminated wherever conditions will permit an alterative construction. The upward pull causes not only mechanical but also electrical troubles, because, during a rain storm, water will run down along the wire into the insulator, which, of course, produces trouble.

The voltages used on present-day high-tension lines are such that the suspension-type and strain-type insulators are rapidly displacing the pin-type insulators. This, of course, means longer and heavier crossarms and higher supporting structures.

HEAT TREATMENT BY ELECTRICITY FOR WIRE DRAWING.

Electricity Is Found to Be More Economical and More Satisfactory than Coke for Heating Steel in Manufacture of Wire.

In the manufacture of steel wire the rods as received from the hot rolls are pickled in acid to remove the scale, dipped in limewater to neutralize the excess acid and then baked to drive out the "acid in the steel," the amount of baking depending on how small the wire is to be drawn. If it is to be drawn only one or two holes a short bake is enough, but for five or six holes the stock must be baked for several hours to withstand the severe drawing. The wire may be, in some cases, additionally heated to dry off grease or oil, or for a low anneal.

At the plant of the Holcomb Steel Co., Syracuse, N. Y., where the operating data in this item was obtained, there are two electric drying-

Electrically Heated Oven Showing Heaters and Steel Ready for Treatment.

ovens in service. The equipment for these ovens was manufactured by the General Electric Co., Schenectady, N. Y. One of these ovens is 16 ft. long with a cross-section of 6 by 6 ft., and a heater capacity of 96 kw. This oven is

operated at a maximum temperature of 600 deg. F., to dry the wire. The second oven is 40 ft. long by 6 by 6 ft. and has a heater capacity of 234 kw. This oven is used for drying "acid in the steel." The acid-drying process requires a temperature of 350 deg. F., maintained for a period of from 1 to 10 hrs.

Coke and steam-heated ovens are also used to do the same work; thus it is possible to obtain comparative operation costs. In spite of the fact that the cost of electric power is higher than the fuel cost for similar ovens, when the total cost of operating the ovens was considered as shown by the data here outlined, a decided economy was shown by the electric oven. Under normal existing operating conditions the total net cost of oven-treating the steel was $12.93 per net ton in the electric oven and $22.29 in the coke oven. If both types of oven could have been operated to their full capacity the costs would have been reduced to $1.92 per ton in the electric oven and to $2.15 in the coke oven. The power costs per net ton of steel treated in the electric oven are $5.09 for normal production and $1.19 for maximum capacity production. The fuel costs with the coke oven are $0.92 and $0.17 per net ton of steel. The remaining elements of the total costs include the various items of investment charges.

It will be noted from these figures that the electric oven shows a saving over the coke oven of $9.36 per ton of product under existing conditions and a saving of $0.237 per ton under the limiting maximum conditions. The electrically heated oven treated the steel with a consumption of 535 kw-hr. per ton under normal conditions and of 125 kw-hr. per ton under maximum capacity operation.

The costs of operation for acid-drying are lower than for the higher temperature preliminary drying, and do not so strongly favor the electric oven. The actual total costs are $1.44 per net ton of steel treated in the electric oven and $2.02 per net ton treated in the coke oven. Where the ovens are operated at maximum capacity the total costs become $0.70 per ton for the electric oven and $0.66 per ton for the coke oven. The power costs per ton of steel treated in the electric oven are $0.79 for normal production and $0.52 for maximum capacity production. The fuel costs with the coke oven are $0.23 and $0.15 per net ton of steel. The other costs, as before, are made up of investment charges. As operated, this treatment required a power input into the oven of 83 kw-hr. per ton of steel. In the full capacity operation of this process a total input of 54.4 kw-hr. per ton of steel is required.

These figures show that the electric oven can actually be operated cheaper than the coke oven except the one case where it developed a cost of 7% higher. However, these figures take no account of increased perfection and duplication of results in the finished product due to the perfect temperature control, whereby the operating temperature can be quickly changed when desired. Nor do they taken into account the freedom from delay due either to the difficulty of obtaining coke at the ovens or the slower heating of the oven to start work.

In another plant, where wire is not drawn so small, the same type of electric oven is capable of treating steel at 400 deg. F., with a consumption of only 110 kw-hrs. per ton of finished product.

ANNOUNCE NAMES OF NEW OFFICERS OF A. I. E. E.

The canvass of the ballots cast in the recent annual election of the American Institute of Electrical Engineers, the unofficial result of which was announced in ELECTRICAL REVIEW several weeks ago, shows that the following men were elected: President, A. W. Berresford, Milwaukee, Wis.; vice-presidents, E. H. Martindale, Cleveland, O.; Charles Robbins, East Pittsburgh, Pa.; C. S. Ruffner, New York City; C. E. Magnussen, Seattle, Wash.; C. S. McDowell, Schenectady, N. Y.; L. T. Robinson, Schenectady, N. Y.; managers, E. B. Craft, New York City; Harold P. Smith, East Orange, N. J.; James F. Lincoln, Cleveland, Ill.; treasurer, George A. Hamilton, Elizabeth, N. J.

Installation of Three Ovens for the Heat Treatment of Steel in Wire Manufacture.

EDITORIAL COMMENT

"No Accident Week" in New York and Pennsylvania

An announcement to the effect that the public utility interests of New York and Pennsylvania have designated the second week in June as "no accident week" during which an accident-prevention drive will be executed will be well received, since it will afford at least one opportunity for employe and employer to co-operate for their mutual welfare. The time has passed when an injury to an employe is his individual loss. Although the misfortune is his alone, the loss is divided in a three-cornered ratio among him, his employer, and the public. No one can stipulate what the ratio is, but it is of sufficient import so that each of the three appreciates its portion and is willing to incur considerable expense to avoid it. No laborer or other individual can anticipate the prospect of a maimed body with any degree of pleasure, no employer can enjoy the stigma that attaches to the proprietor of a plant in which accidents are frequent, and no community can be exultant over the amount and variety of demands made on its charitable institutions.

Because the plan for "no accident week" is referred to as a "drive" is no reason to suppose that it will not receive hearty support. As long as the purpose which caused its designation exists, namely, self-preservation and protection, the undertaking, by whatever name designated, will be popular. An illustration of this fact is shown by the effect of the German drives on the public mind. The first drive was viewed as something of a thriller by the people of this country. Had those repeated assaults meant nothing more to Americans than an exhibition of the German ability to plunder and lay waste territory, they would have lost some of their glamor. But a realization of the fact that American independence would stand or fall on the success of those drives created an increasing rather than a lagging interest in them.

If the "no accident" drive prevents only one injury, it will be worth while. Experience indicates, however, that a large reduction in the prevailing number of accidents will occur. One has only to refer to the extensive reduction in accidents that occurred during the safety week campaign in November, 1919, to appreciate the value of these movements. One may express the hope that the undertaking by the New York and Pennsylvania utilities will be imitated by others. Such campaigns will reduce the normal number of accidents. They will, moreover, provide an issue in which employer and employe can co-operate with the certain knowledge that each is endeavoring to do something unusual for the other.

Giving Public Utilities Fair Consideration

In its essence the problem of rate regulation for the public utilities is fairly simple. It is a matter of knowledge and agreement. If the public is fully informed it is likely to find it to its own interest to give fair treatment to the companies. Once it is made plain that the cost of operation and a fair return upon capital invested requires rates of certain levels, the necessity of charging such rates is likely to be recognized. The difficulty is frequently one of arriving at a common understanding of what is actually involved.

In this connection it is encouraging to note the success with which such an understanding was arrived at in a recent instance, in which the common councils of the municipalities of Newport News, Hampton and Phoebus and the Newport News & Hampton Railway, Gas & Electric Co., Hampton, Va., were the interests concerned. This spring the company found itself facing a deficit of $76,000, owing to the increased cost of labor and materials. It required $250,000 for capital expenditures to maintain the kind of service it had been giving its patrons.

The management frankly stated these facts to the common councils of the three municipalities. With a full statement of earnings were also presented costs of operation, materials, etc., and the actual figures of capitalization and appraised values. Having presented these facts, the company asked the municipal authorities for relief, but specifically requested that such relief as was granted be granted as the local authorities thought best. No effort was made to indicate a policy or to dictate a plan. The only suggestion made by the management was that the cost of new capital probably would be about 8% and that therefore such rates as might be increased should have a relation to the cost of capital.

In meeting the situation the local authorities of the three municipalities showed much more than the average intelligence of such bodies and were inspired by the sentiment of fairness. They did not at any time enter any objection to the

main premises of the company that it should have a larger revenue or sufficient revenue to provide for the threatened deficit and for new capital requirements. Since the company derives its revenues from traction, electric and gas service, the argument of the councils was entirely taken up as to which of these different facilities should contribute most to make up the amount involved. As profits from electric light and power showed a substantial increase while the earnings from the traction lines were largely reduced and it was from this source that the company chiefly faced a deficit, with net earnings from the gas plant also on a declining scale, the councils recommended increases in the street-car fares and in the gas rate.

A fact of broad significance in their recommendations was that the municipal authorities took into account in making these rates the right of the company to receive 6% on the capital invested in the property prior to 1920 and 8% on capital to be invested thereafter or during the two-year period when the new rates were to be in effect. They thus took a step forward and recognized, as applied to the public utility, the principle involved in the new Cummins-Esch law, according to which rates are to be established on the basis of the 5½% or 6% return on capital invested.

The incident indicates that whenever a public utility has given good service, has frankly brought its problems to the local community and has requested a fair deal, it will get fair treatment. It has the further implication that in such recognition of the needs of the public utility company the community is likely to be acting to its own advantage. In these days capital is likely to gravitate to centers where it receives just consideration. In dealing fairly with the Newport News & Hampton Railway, Gas & Electric Co., these communities have unconsciously brought a prestige to themselves which will be of great value in the upbuilding of their industrial life.

Enough Engineering Societies

Engineers will be interested in the action taken by the delegates to the Organizing Conference held in Washington during this week, since upon it will depend the rapidity with which a consolidation of engineers into a comprehensive organization can be effected. The delegates must adopt or reject the proposal to form a confederation of all societies, local and national. Should they adopt it and launch a third organization that will be a competitor of existing organizations now functioning satisfactorily they will complicate intersociety relations. Should they reject it they will settle without further dispute the question of these relations. The former action involves grave consequences for engineers; the latter does not. Consequently, the delegates should consider their actions carefully before they commit themselves or their constituents to any undertaking likely to alter existing intersociety conditions.

If the attitude of engineers who have had a chance to express a preference for a federated organization is a barometer of the attitude of all engineers, the advisability of launching a new comprehensive organization is questionable. Not only has the idea not been approved by a referendum canvassed in a group of national importance, but it has been rejected by the only clear-cut referendum that has occurred. The rejection of the confederation by the members of the American Society of Civil Engineers had a ring to it that is undisputable. Although the majority against it was not large, it was sufficiently distinct to leave no doubt about its meaning. It is unfortunate, indeed, that the members of all of the founder societies have not had an opportunity such as the civil engineers have had to express a preference on this important question. It seems incredible to think that the officers of any society would venture the formation of a comprehensive society which will be a competitor of existing organizations and which has been definitely rejected by the *vox populi* of one of the most important founder societies before the proposal has been submitted to a ballot of all engineers intended to be represented by it.

The dissatisfaction that has been expressed with the delegated authority of the Engineering Council and the consequent refusal of engineers to support it, though withal a worthy and even necessary organization, should constitute a warning to officers of societies contemplating the formation of other organizations. Any organization of engineers must depend upon them for financial support. This will come grudgingly or not at all if the principle of the selective draft is employed to recruit the membership. If support for Engineering Council, a logical organization, could not be enlisted, one has difficulty in understanding how support for a supernumerary organization can be developed. The American engineer is a wonderfully democratic and deliberative individual. He has a peculiar way of ascertaining what he wants and of refusing to take a substitute. How he will receive the idea of supporting an organization in the formation of which his opinion was neglected and even ignored is a question. It seems reasonable to suppose that he should be interrogated carefully before he is asked to support a confederated society particularly if it is intended to be a competitor of existing societies that are flourishing.

CURRENT EVENTS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

COMMONWEALTH EDISON CO. ISSUES $5,000,000 IN NOTES.

Chicago Company Obtains Loan from Syndicate of Chicago Bankers for Five-Year Term at Satisfactory Interest Rate.

The Public Utilities Commission of Illinois has sanctioned an issue of $5,000,000 of five-year 7% collateral gold notes by the Commonwealth Edison Co., Chicago, and arrangements for the sale of the notes to 14 Chicago banks and bond houses have been made.

The issue will be secured by $7,143,000 first mortgage 5% bonds and in view of the difficulties encountered by other utility companies in the Middle West in floating bonds or obtaining money, the interest rate of 7% is regarded as particularly satisfactory.

While 14 financial institutions are interested in the loan, it is being handled through the Continental and Commercial Trust and Savings Bank bond department. In a letter to the bank handling the loan, Samuel Insull, president of the Commonwealth Edison Co., gave a statement of the operating expenses of the company for the 12 months ended Dec. 31, 1919, which shows operating revenue of $30,366,426 and operating expenses of $19,519,506. Other expenses, including interest and taxes, and also arranging for interest on the notes just issued, leave the net income of the company for the period named $4,464,825.

The company now has more than 415,000 customers, the normal annual increase being from 30,000 to 40,000 customers. Seven generating stations and 52 substations are operated, the generating plants having a capacity of about 830,000 hp. The company and its predecessor, the Chicago Edison Co., has paid dividends since 1889 without interruption, the present rate being 8% per annum.

ENGINEERING COUNCIL INDORSES BOARD OF WORKS PLAN.

Would Have New National Department at Washington to Replace Present Department of the Interior.

The Engineering Council, a national organization, embracing the American Institute of Electrical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, American Institute of Mining and Metallurgical Engineers, American Society for Testing Materials and American Railway Engineering Association, has by a referendum endorsed the project to establish a Department of Public Works by the national government.

Adolph Lewisohn, chairman of the New York committee of the National Public Works Department Association, 61 Broadway, New York City, in announcing the result of the referendum, said that the council voted in favor of the creation of a Department of Public Works "by a suitable modification of the existing Department of the Interior, excluding therefrom the non-related bureaus and offices and by change of name from Department of the Interior to Department of Public Works."

J. Parke Channing, vice-chairman of the New York committee, is chairman of the Engineering Council. Mr. Channing said that the United States Chamber of Commerce committee on the Department of Public Works has reported that existing conditions are not calculated to promote efficiency and economy and that the undertaking met its approval. Mr. Lewisohn said that the National Federation of Construction Industries, the most important body in the construction field of this country, has by a referendum overwhelmingly indorsed the public works movement.

Hugh Frayne has been added to the New York committee as a representative of labor. This committee now embraces a wide representation of business, engineering, industrial and professional interests.

UNITED STATES COURT OF APPEALS RULES IN HUBBELL SUITS.

Decisions Made in Regard to Manufacture of Attachment-Plug Devices and of Double Receptacles.

In reference to litigation concerning the Hubbell patents, wherein Harvey Hubbell, Inc., the General Electric Co. and the Bryant Electric Co. were interested, the following statement has been made by Harvey Hubbell, Inc.:

"In the suits by Harvey Hubbell, Inc., against the General Electric Co. and the Bryant Electric Co. upon Hubbell patents Nos. 774,250 and 774,251, the United States Circuit Court of Appeals has filed an opinion holding that the open-contact devices sold by the General Electric Co. and the Bryant Electric Co. (the latter under the name of Spartan receptacles) do not infringe upon the Hubbell patents, upon the ground that the latter are limited to the use of concealed contacts, that is to say, attachment-plug devices in which the contact blades of the cap must pass through guide holes before engaging the contact springs in the contact-spring chambers. Thus the defendants are free to manufacture devices of the wide open contact type, but are not free to manufacture devices having the concealed contacts of the Hubbell line.

"In the suit of the Bryant Electric Co. against Harvey Hubbell, Inc., upon the Burton patent

No. 1,169,613 relating to a double receptable adapted to take either parallel or tandem blades, the same court has filed an opinion holding the Burton patent invalid. This suit was directed against the Hubbell line of double receptacles having the double 'T' slots which are arranged to take both parallel and tandem blade caps. The result of this decision is that the Hubbell company is free to continue the manufacture and sale of its double 'T' line of receptacles and that the General Electric and Bryant companies are free to continue the manufacture of their four-window type of double receptacles, but cannot use the double 'T' device of the Hubbell patent."

CHICAGO NOT TO HOLD ELECTRICAL SHOW THIS FALL.

Chicago will not hold an electrical show next fall, as had been planned earlier in the year, the project of having an exhibition having been abandoned recently. The reason is the unsettled condition of the manufacturing market and the fact that the time scheduled for the holding of the show, which was in October, will find the country in the midst of a presidential election campaign.

It was the consideration of these two elements that prompted this action, stated E. W. Lloyd, of the Commonwealth Edison Co., who was manager of the successful show held last fall and who was to act in the same capacity this year. "The fact that it is a presidential election year and the unsettled condition of the manufacturing market were the main reasons for not holding a show this year," said Mr. Lloyd. "With the entire country facing a season of not sufficient production it did not seem advisable to ask manufacturers and dealers to co-operate in such a large show as the Chicago exhibition would have been."

Chicago's electrical show last October, the first one held after a lapse of eight years, was very successful and was attended by over 80,000 visitors. That the giving of annual shows in Chicago would be resumed when business conditions became normal was indicated by Mr. Lloyd.

STOKER MANUFACTURERS OUTLINE ORGANIZATION WORK.

That the Stoker Manufacturers' Association has just as great a work to perform now and in the future as it had during the war period was the declaration made by President P. A. Poppenhusen in his opening address at the recent convention of the association held in Lakewood, N. J. The association is needed to promote a co-operative spirit, maintain high ethical standards of business and to make customers realize the necessity and value of mechanical stokers, he said. Papers were read at the convention by S. A. Armstrong, Henry Kreisinger and A. R. Maujer. The officers elected for the ensuing year are as follows: President, R. Sanford Riley, Sanford Riley Stoker Co.; vice-president, M. Alpern, American Engineering Co.; treasurer, H. E. Pratt, Babcock & Wilcox Boiler Co.; secretary, J. G. Worker. The members of the executive committee include the officers and H. A. Hatton, Laclede Christy Clay Products Co., St. Louis, Mo., and S. A. Armstrong, S. A. Armstrong Underfeed Stoker Co. of America, Detroit, Mich.

CONVENTION ARRANGEMENTS ARE GIVEN PRAISE.

James A. Davidson Is Made Chairman of Public Relations Section of the National Electric Light Association.

Delegates and visitors to the recent convention of the National Electric Light Association at Pasadena, Cal., who live in Chicago, or who passed through that city on their way to eastern homes, are loud in their praises of the excellent manner in which the convention committee and the city of Pasadena entertained them.

According to the opinions expressed by those who have returned nothing was left undone to make the stay of the visitors in the California city all that could be desired in an entertainment way. Another point emphasized by those in attendance at the convention was the splendid manner in which the business and section sessions of the convention were arranged.

So ably had the program been worked out in advance that the usual conflicts of sessions on matters of general interest was avoided and all of the delegates were able to hear practically all of the important papers and discussions of the sessions.

At the final sessions of the convention resolutions of thanks were extended to Gov. W. D. Stephens of California for the reception given the delegates by the state. Similar resolutions were extended to the civic officials of Pasa-

Group of Delegates to the Forty-Third Annual Convention of the National Electric

dena and the Chamber of Commerce of the city.

The committee on resolutions also extended the thanks of the association to the retiring president R. H. Ballard, Carl D. Jackson, chairman of the Wisconsin Railroad Commission; E. O. Edgerton, chairman of the California Railroad Commission, and Henry Suzallo, president of Washington University, Seattle, Wash., for the addresses delivered by them to the delegates.

At the organization of the public relations section, following the announcement of its personnel by M. J. Insull, the new president, James A. Davidson was made its chairman, thus becoming the first head of the newly created section. Mr. Davidson is a veteran in the electrical industry, his first connection being with the Port Huron, (Mich.) Light & Power Co., of which he was general manager for several years, leaving that company in 1905 to become general manager of the Consolidated Lighting Co., of Montpelier, Vt. In 1910 he became vice-president of the Pacific Power & Light Co., at Portland, Ore., which position he retained until 1917 when he became vice-president and general manager of the Nebraska Power Co., which position he holds at the present time.

At the final session of the accounting section J. C. Van Duyne of the Brooklyn Edison Co., was elected chairman. Mr. Van Duyne served as vice chairman last year. Other officers elected were William Schmidt, Jr., Baltimore, Md.; E. J. Fowler, Chicago, and William Long, Philadelphia, vice-chairmen. The executive committee consists of the following men: W. A. Jones, Joplin, Mo.; R. R. Reidford, San Francisco, Cal.; Oliver McCormick, Chicago; H. M. Edwards, New York City; G. M. Guilford, Boston, and H. I. Hughes, Denver.

ASSOCIATED MANUFACTURERS WILL MEET AT NEW LONDON.

The Associated Manufacturers of Electrical Supplies will hold their summer meeting at The Griswold, New London, Conn., June 28-30, it being the third time the summer meeting has been held at this point. On Monday, June 28, there will be a joint meeting of all the sections of the association, for which special entertainment will be provided.

The section meetings will be held at convenient times during the regular sessions on a schedule to be announced later. The general standards committee, having completed its organization and appointed its working committees, will hold its third meeting during the sessions. The board of governors will also be in attendance at the sessions and hold its June meeting during the week. Charles E. Dustin is general secretary of the association, with offices at 30 East 42d street, New York City.

ENGINEERS DISCUSS FEDERATION OF ORGANIZATIONS.

Organizing Conference of Delegates of National, Local, State and Regional Bodies Hold Meeting in Washington, D. C.

The conference of delegates representing the national, local, state and regional engineering organizations of this country held in Washington, D. C., June 3-4, is the first meeting of its kind and was one of the most important ever held by the engineering profession in this country, despite the fact that definite action was not taken at the meeting. It was the first meeting ever held in an attempt to bring about a solidarity in the profession through a federation of the engineering organizations.

The American Society of Civil Engineers was founded in 1852 by a small group of engineers for the purpose of promoting sociability among the relatively few engineers in the country and for the advancement of engineering knowledge and practice and the maintenance of a high professional standard among its members. Subsequently the American Institute of Mining and Metallurgical Engineers was organized in 1871, the American Society of Mechanical Engineers in 1880 and the American Institute of Electrical Engineers in 1884. Still later in 1898 the American Society for Testing Materials was formed and in 1899 the American Railway Engineering Association was organized. Other organizations were formed at later dates. All these are primarily technical societies and have practically no non-technical activities. In addition to the numerous national societies that have been organized to care for special lines of engineering, local engineering societies and clubs, as well as state and regional engineering organizations, have been formed. These organizations, generally speaking, carry on their activities independently of each other.

The conference in Washington was the result of joint action on the part of the four older engineering societies, which formed a joint confer-

Light Association, Held at the Huntington Hotel, Pasadena, California, May 18-22.

ence committee that issued invitations to about 100 engineering organizations in this country to attend the meeting in Washington. About 60 of them responded and at the six sessions in Washington last Thursday and Friday about 150 delegates, representing societies having an aggregate membership of 150,000 engineers, were present and took part in the discussions. The results of the discussions will be announced later to the engineering organizations through their delegates who attended the Washington sessions.

WESTINGHOUSE NET INCOME FOR YEAR $15,206,341.

Annual Report for Year Ended March 31, 1920, Shows That Company Had Total Billings of $136,052,092 in 12-Month Period.

The annual report of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., just made public and which will be submitted at the stockholders' meeting June 9, shows that during the fiscal year of the company, ended March 31, 1920, the total billings amounted to $136,052,092 with the cost of sales totalling $120,972,262, leaving $15,079,830 as the net manufacturing profit for the year. Other income brings this total up slightly leaving the net income available for dividends and other purposes $15,206,341. Accompanying is a condensed comparative statement of operations for the year ended March 31, and the preceding five years:

Throughout the fiscal year, but more particularly during the past six months, there was a gradually increasing demand for the company's products. The value of unfilled orders on April 1, 1920, was $71,156,732. Dividends at the rate of 8% per annum were declared quarterly during the year and aggregated $5,984,898. The surplus March 31, 1920, is $43,435,763, being an increase of $7,488,031 over the surplus of April 1, 1919.

The property and plant account, representing real estate, buildings, equipment, etc., shows a reduction as compared with the previous year due in part to the sale of certain plants which were engaged mainly in the manufacture of munitions.

The development and business of the company together with the increased cost of operation due to higher wages and higher prices for raw materials required a large amount of additional capital. These requirements were met in part by the sale of certain investments in other companies, principally the foreign holdings of the Westinghouse company, and in part from surplus earnings retained in the business. The current demand for the company's products is in excess of its present plant capacity and a continuation of this demand will make necessary further additional facilities and still larger working capital.

Inclosed with the annual report is an illustrated folder "Recent Notable Achievements," in which are given details and illustrations of the Westinghouse company work in connection with the electrification of the Chicago, Milwaukee & St. Paul railroad, Pacific Coast division.

STATEMENT OF OPERATIONS—WESTINGHOUSE ELECTRIC & MANUFACTURING CO.

	1920	1919	1918	1917	1916	1915
Gross earnings—sales billed	$136,052,092	$160,379,943	$95,735,407	$89,539,442	$50,269,240	$33,671,485
Cost of sales	120,972,262	144,667,402	80,225,937	72,077,752	40,839,344	31,551,350
Net manufacturing profit	15,079,830	15,712,541	15,409,470	17,461,690	9,429,896	2,120,135
Other income	1,721,334	1,623,262	1,325,263	1,386,547	1,106,730	1,158,527
Gross income from all sources	16,801,164	17,335,803	16,834,733	18,848,237	10,536,626	3,278,662
Interest charges	1,594,823	2,276,795	1,429,052	768,348	869,837	1,268,918
Net income available for dividends and other purposes	15,206,341	15,059,008	15,405,681	18,079,889	9,666,789	2,909,744

JOINT ENGINEERING MEETING IN NEW YORK CITY.

A special joint meeting of the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, and the American Society of Civil Engineers was held in New York City, May 26, at which subjects about Russia that are of interest to engineers were discussed. Walter N. Polakov, a member of the American Society of Mechanical Engineers, presided. The speakers and their subjects were:

N. A. Stephanoff, president Russian Society of America, who spoke on the Russian engineering situation; W. F. Dickson, director, Russian Singer Co., who spoke on the accomplishments of Russian engineers; and Dr. J. M. Goldstein, professor of economics, Moscow University, who talked about the resources of Russia. Mr. Polakov compared Russian and American engineers. Mr. Dickson, who has lived in Russia during the last 25 years, spoke of the engineering developments that he has observed in Russia. He showed that in the construction of bridges, tunnels, aeroplanes, electrical appliances and in other ways, the Russian engineers are second to none.

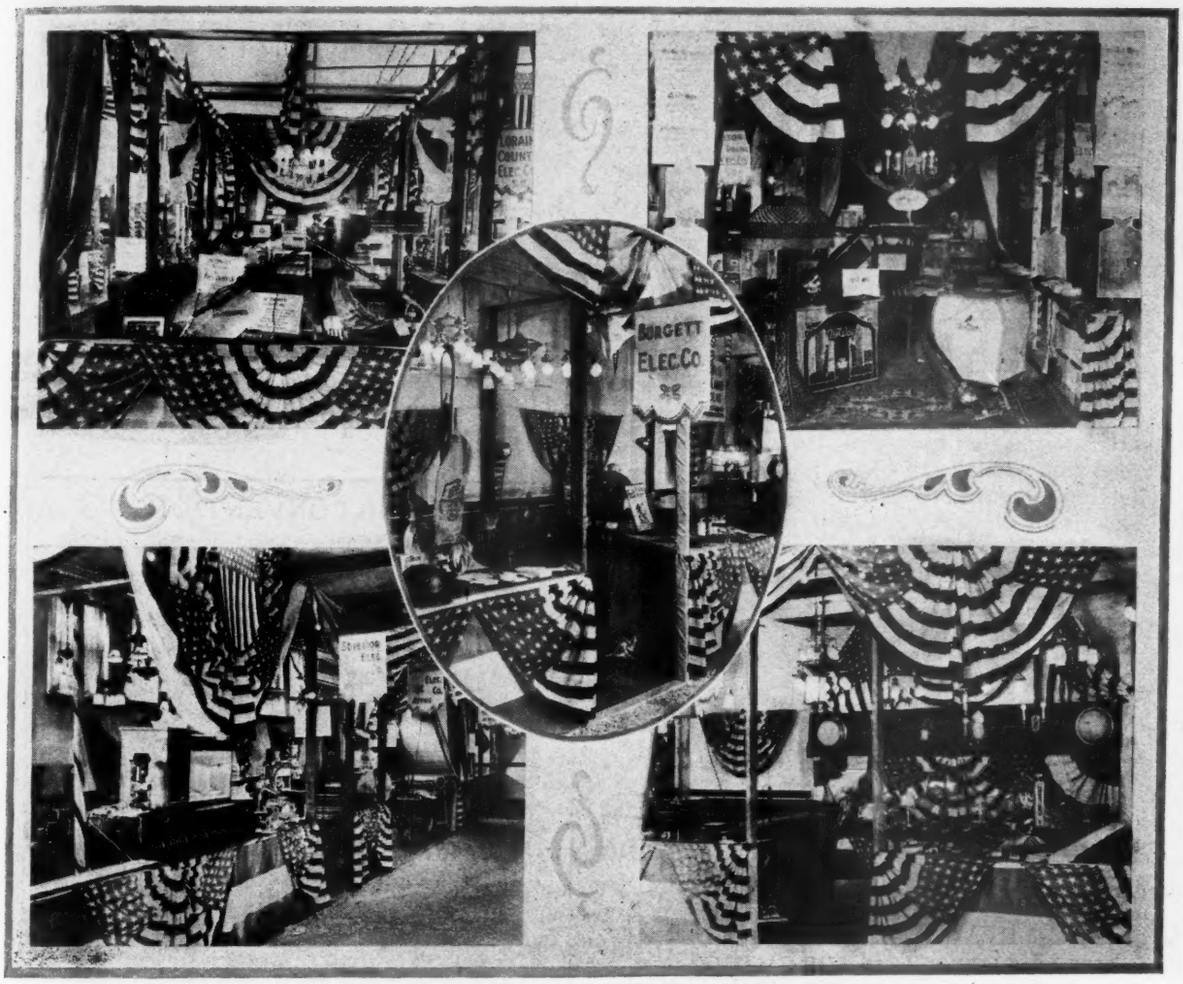
LORAIN ELECTRICAL SHOW PROVES BIG SUCCESS.

Exhibition Is Well Attended and Many Fine Showings of Electrical Appliances Made by Contractor-Dealers.

The first electrical show ever held in Lorain, O., was given during the week beginning May 25 and proved to be most successful both from the standpoint of the patrons, who were well pleased with the splendid display of electrical appliances shown, and of the contractor-dealers and others interested in the show, for the good results attained.

The show was made possible by the co-operation of the different branches of the electrical industry in Lorain. To secure the interest of the public, the Electrical Contractors' Association asked all the citizens to illuminate their porch lights on the opening night.

More than 30 separate exhibits were in the show, practically all of them being displays of



Some of the Exhibits at the Lorain (O.) Electrical Show.

In the upper left-hand corner is shown one of the two booths of the Lorain County Electric Co. In the upper left is the booth of the Walton-Doane Electric Co. The exhibit made by the Superior Electric Co. is shown in the lower left-hand corner and that of the Miller Electric Co. in the lower right-hand corner. In the oval in the center is the booth of the Burgett Electric Co.

electrical goods or allied lines. It was noticeable at the show that electrically operated labor-saving devices attracted the most attention from the visitors and most of the exhibits featured this sort of appliance, rather than the purely decorative effects and lighting materials.

The Lorain County Electric Co. had a display of the latest developments in electrical appliances and gave practical demonstrations of the workings of the appliances. The Electric Service Co. showed a complete line of appliances, including electric pumps and an air purifier for residence and office use. The Superior Electric Co., which operates a chain of retail stores in northern Ohio, was one of the largest exhibitors. The Walton-Doane Co. demonstrated an electric range in its booth. A complete line of residence types of lamp fixtures and small appliances was shown by the J. S. Miller Electric Co. Another striking display was that of the Burgett Electric Co. consisting of lighting fixtures, small appliances and glassware. The M. S. Ault & Co., the Wickens Co. and Kirkland-Bond Co. all had booths that attracted many visitors.

In addition to the exhibits of the contractor-dealers and the central-station company, the electrical workers of the city had an exhibit showing old and new methods of wiring, and also contributed to the success of the show by doing all the wiring and installing of exhibits free of charge. Lorain high school boys had an exhibit of wireless telephone and telegraph equipment.

So successful was the show that J. C. McClendon, manager of the commercial department of the Lorain County Electric Co., who was at the head of the show committee, stated that it is planned to make the exhibit an annual affair in Lorain.

ONTARIO HYDRO-ELECTRIC COMMISSION TO BUILD STEAM PLANT.

Announcement has been made by Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, that the 50,000-hp. steam reserve plant which will be built during the coming year will, upon its completion, be enlarged to 100,000 hp. The first 50,000 hp. will be ready by September, 1921, when the city of Toronto (Ont.) is to take over the Toronto street railway. A steam reserve plant was not built previously because the commission had plenty of power, but now it is constantly using its maximum supply of power and there is need for a steam plant to carry the peak. Also con-

ditions at the existing power plants at Niagara Falls at times during the winter and spring are not very satisfactory, due to ice troubles. The Canadian Niagara Power Co. at times last winter developed only a fraction of the capacity of the plant, resulting in a great shortage of power on the commission's system, as the Canadian Niagara Power Co. is under contract to supply the commission with 60,000 hp.

PENNSYLVANIA DEALERS TO MEET IN PITTSBURGH.

The Pennsylvania State Association of Electrical Contractors and Dealers will hold its quarterly session in Pittsburgh, Pa., June 23-24, with headquarters at the Fort Pitt Hotel. William L. Goodwin, Samuel A. Chase and others will discuss topics of interest to the industry. The full details of the program will be announced later by M. G. Sellers, secretary-treasurer of the association, 1518 Sansom street, Philadelphia, Pa.

ROCHESTER ENGINEERS DISCUSS FARM LIGHTING.

At the May meeting of the Rochester Section of the American Institute of Electrical Engineers, held May 28, C. H. Roth, of the Willys Light Co., was the principal speaker, having as his subject "Light and Power for the Farm," in which he explained how the engineers of his company are giving the farmers the benefit of light and power.

CHICAGO ENGINEERS HEAR ADDRESS ON AUTOMATIC SWITCHING.

At the May meeting of the Western Society of Engineers, held in their quarters, Chicago, May 24, Fred L. Baer, sales engineer of the Automatic Electric Co., read a paper on "The Transition from Manual Switching to Automatic of Telephone Traffic in Large Metropolitan Networks." At the meeting the election of officers of the telephone, telegraph and radio section of the society was held, the election resulting in the following men being named: Frank F. Fowle, chairman; Stanley R. Edwards, vice-chairman; Montford Morris, director (three-year term); Morris A. Frye, director (two-year term); Fred L. Baer, director (one-year term).

MECHANICAL ENGINEERS NAME NEW SPECIAL COMMITTEE.

The American Society of Mechanical Engineers has recently formed a new organization to be known as the special committee on professional sections, the functions of the committee being to form, foster and co-ordinate technical sections as the demand arises. The object of the professional sections is to promote the mechanical engineering of the arts to which they are devoted, either by the preparation of technical papers, discussions and debates, or by technical research.

The following is the personnel of the committee with the branches represented: Howard E. Coffin, Detroit, Mich., aeronautics; Francis W. Kelly, Albany, N. Y., cement; David M. Myers, New York City, fuel; George A. Orrok, New York City, gas power; Henry J. Eberhardt, Newark, N. J., machine shop; Robert H. Fernald, Philadelphia, power; C. F. Hirschfield, Detroit, Mich., ordnance; E. B. Katte, New York City, railroads; George H. Perkins, Boston, textiles.

M. H. AYLESWORTH WILL ADDRESS CANADIAN ASSOCIATION.

The Canadian Electrical Association will hold its annual convention at the Ritz-Carlton Hotel, Montreal, Que., June 16-18. The first day of the convention will be devoted to reports of committees and reports of delegates to the recent National Electric Light Association convention at Pasadena, Cal. On the second day, M. H. Aylesworth, executive manager of the N. E. L. A., will address the convention on the work of the association and also on the geographic division plan approved at the national convention. Paul M. Lincoln will present a paper on maximum-demand meters. Other papers to be announced later will also be presented.

COMING CONVENTIONS.

North Central Geographical Division of the National Electric Light Association. Annual Convention, Minneapolis, Minn., June 16-17. Headquarters. Radisson Hotel. Secretary, M. Barnett, Northern States Power Co., St. Paul.

Iowa Section of the National Electric Light Association. Annual Convention, Colfax, Ia., June 23-25. Assistant Secretary, Rex H. Clark, Des Moines, Ia.

American Institute of Electrical Engineers. Annual Convention. White Sulphur Springs, W. Va., June 29-July 2. Headquarters, The Greenbrier. Secretary, F. L. Hutchinson, 33 West 39th street. New York City.

Ohio Electric Light Association. Annual Convention. Cedar Point, O., July 13-16. Secretary, D. L. Gaskill, Greenville, O.

Pacific Coast Section of the National Electric Light Association. Annual Convention, Portland, Ore., July 21-23. Chairman, R. M. Boykin, Portland, Ore.

Michigan Section of the National Electric Light Association. Annual Convention, Ottawa Beach, Mich., Aug. 24-26. Headquarters, Hotel Ottawa. Secretary, Herbert Silvester, Ann Arbor, Mich.

New England Section of the National Electric Light Association. Annual Convention, Kineo, Me., Sept. 13-16. Secretary, O. A. Bursiel, 149 Tremont street, Boston, Mass.

National Association of Electrical Contractors and Dealers. Annual Convention, Baltimore, Md., Oct. 4-8. Headquarters, Southern Hotel. Secretary, W. H. Morton, 110 West 40th street, New York City.

NEW YORK ELECTRICAL SOCIETY HOLDS 383RD MEETING.

At the 383rd meeting of the New York Electrical Society held May 26, Kenneth S. Johnson, of the engineering department of the Western Electric Co., delivered an illustrated lecture on the elementary phases of telephone transmission engineering. Mr. Johnson described the equipment used in the modern exchange and showed wiring and other diagrams to illustrate his remarks.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

CENTRAL-STATION COMPANY ISSUES FARMERS' BOOKLET.

Wisconsin-Minnesota Light & Power Co. in Publication Describes Advantages to Be Gained by Electrifying the Farm.

"Electricity on the Farm" is the title of a booklet published by the Wisconsin-Minnesota Light & Power Co., Eau Claire, Wis., which is being distributed to farmers in the sections served by the company. The aim of the booklet is to tell the farmers of the opportunity open to have electricity on the farm, the company offering service from its high-tension lines, of which it has a network in the vicinity of Eau Claire, the city being the center of a large farming district.

Electricity on the farm is not a luxury but a necessity, is declared in the booklet. The farmer needs electric lighting, an electric washer, an electric fan, an electrically pumped water supply; electric motors for operating the cream separator, to grind feed, to cut and elevate ensilage, to cut wood and to operate other general devices. He needs electric lighting in the house and in all the farm buildings and yards, and having them means economy in operation.

The booklet explains that co-operation of the farmers is necessary to the success of the plan of the company for electrifying the farms in its territory, because it is required that the company obtain a number of farmers on each transmission line in order to give electric service to the mutual advantage of the farmer and the company. The company proposes during the present year to furnish electricity for as many farming centers as it is possible for it to construct lines for during the year.

Details of all appliances for use in connection with farm work are given in the booklet, together with the cost price and the amount of electrical energy needed to operate them, the figures being given in money terms as well as electrical.

STANDARD GAS & ELECTRIC CO. HAS 442,972 CUSTOMERS.

The record of the utility subsidiaries of the Standard Gas & Electric Co., which now serves 2,200,000 people, is described in an illustrated booklet just issued by H. M. Byllesby & Co. Charts show a steady increase of both gross and net earnings for the past nine years, and photographs are given of many of the modern water power, steam electric stations and natural and manufacturing gas properties.

Attention is called to the fact that the subsidiary companies now have upwards of 15,000 home shareholders, owning about $12,000,000 of preferred stock and receiving more than $840,000 a year in dividends. The Standard company's principal properties are in such cities as Minneapolis and St. Paul, Minn.; Louisville, Ky.; Oklahoma City and Muskogee, Okla.; Fargo and Sioux Falls, S. D.; Pueblo, Col.; Tacoma, Wash.; and Stockton and San Diego, Cal.

At the close of 1919, the utility subsidiaries of the company were serving 442,972 customers,

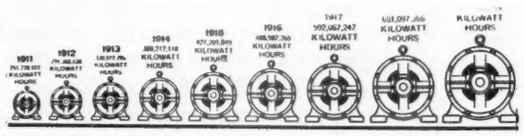


Chart Showing Commercial Growth of Standard Gas & Electric Co.

an increase of 35,368 during the year. The users of electricity are by far the greater number, or 284,771, requiring 770,857,955 kw-hrs. for their necessities in 1919.

CLASSES ORGANIZED BY UTILITY WORKERS GET RESULTS.

Philadelphia Electric Co. Employes in Fortnightly Class Meetings Use Unique Method of Marking Study Papers.

Employes of the Philadelphia Electric Co. appear to have struck a happy medium of maintaining interest and getting results at one and the same time in their method of conducting the National Electric Light Association educational courses. Their classroom idea seems to have been quite successful, according to an article recently written by M. C. Huse, a member of the class organization.

Last September there was organized among the employes of the company a class of 227 students in the commercial engineering course of the N. E. L. A. It was deemed expedient to hold the class meetings and discussions twice a month, each meeting being devoted to a single lesson of the course. In certain departments the students were also organized under a group leader, each group then constituting a class in itself for the detailed discussion of the various lessons. In this way each student was able to express himself freely and to formulate his own opinions.

The attendance at the bi-monthly meetings, which includes all groups, has averaged over 200. This includes a certain number of employes, not enrolled in the course, who are invited to attend. At each meeting some speaker of recognized authority has discussed the lesson and thereby greatly enhanced the value of the course. In each case the talk has been prepared after a careful examination of the material included in the textbooks, so that the speaker has been able to develop the subject along the lines indicated

in the course. It is interesting to note that these speakers have, without exception, voiced the opinion that the material contained in the textbooks is admirably prepared and constitutes a most valuable resume of the various subjects included in the educational course.

Due to the fact that a number of students were unfamiliar with elemental electricity, 15 minutes at each meeting is devoted to a demonstration of the principles of electricity. In this way the student is prepared for the somewhat technical matter contained in the latter part of the course.

In order to properly grade the students for their attendance at class and their promptness in reporting the answers to the lessons, the following plan was adopted: A grade of 70% is required in class work in order that the student may pass satisfactorily from the standpoint of those who are conducting the course. A penalty of 15% is deducted for each unexcused absence and a penalty of 5% is deducted for an unexcused delay in returning the answer to a particular lesson. A maximum period of two weeks is allowed after the class lesson during which the answer paper can be returned without incurring a penalty.

In order to be sure that the student retains a familiarity with the information contained in the lessons and does not simply copy the answers from selected parts of the text, a test is given at every five lessons. The test consists of five questions, one selected from each of the five preceding lessons. The written answers to these questions are then corrected and returned to the student, a record being kept of the mark received. Any student who shows himself negligent then receives special attention from the group leader, thus giving the student a chance to iron out his difficulty.

It is claimed that the methods followed in conducting the course have been thoroughly justified by the results which have been obtained. Excluding those students who have been obliged to leave the class, due to the fact that they are no longer in the employ of the company, there has been practically no decrease in the attendance at the class lessons and with very few exceptions, all the men enrolled in the course have continued to promptly and carefully answer the questions relating to the various lessons.

NEW YORK EDISON CO. DISTRIBUTES BOOKLET ON AUTO TOURS.

Describes Trip in 250-Mile Radius Around New York City and Gives Other Information on Electric Vehicles.

Electric vehicle tours to points within radius of 250 miles of New York City are described in a booklet which the New York Edison Co. has just published for free distribution to electric car owners. The booklet also lists all electric automobile charging stations and garages in and around New York City. Two route maps are included showing trips which may be made in an electric starting from New York City to points as far away as Buffalo, Albany, Pittsfield, Mass., Hartford, Conn., Atlantic City, N. J., or Philadelphia.

Owners have come to realize that the electric vehicle is capable of making longer trips than it has generally been called upon to make. It was to give information about such trips and to comply with constant requests for up-to-date lists of charging stations around New York City that this booklet was published. A great deal of very valuable information on the care of batteries is included in the book.

Boston Company Uses Novel Method to Promote Good Will of Customers

Wouldn't you feel better if when you were paying your electric lighting bill you saw the word "please" beaming down on you in electric lights rather than just the cold and undiplomatic "Pay Bills Here?" That is one of the many ways that the Edison Electric Illuminating Co. of Boston has adopted to gain the good will of its customers and is gaining it just by the use of the little word "please." Formerly the signs in front of the cashier's booths of the various offices of the company where customers pay their lighting bills had illuminated signs "Pay Bills Here" on them. Now the signs read "Please Pay Bills Here" and the company reports many favorable comments on the innovation.

OPERATING PRACTICE

Methods and Problems Embracing Operation and Installation of Power-Plant Equipment and the Distribution of Electrical Energy

AERIAL CABLE FOR TRANSMISSION OF POWER.

Energy Transmitted Through Center of City Over 13,000-Volt Cable Hung by Means of Catenary Suspension.

Where underground duct lines are filled, where economy of construction is essential, or where service must be given in the shortest possible time, overhead cables are coming into use for the transmission of power. Other considerations sometimes favor the overhead cable. In one instance a 26,000-volt overhead cable was carried over two railroad crossings located approximately 500 ft. apart. Four sets of potheads, with their possibilities for trouble, were eliminated by adopting this type of construction instead of going under each track. In this particular case the line was constructed with open wire in one direction and with underground cable in the other direction from the crossings. The cable was considered to represent better construction over the tracks than open-wire work and so was adopted, the connection between overhead open-wire construction and overhead

Corner Pole and Turn in a 13,000-Volt Overhead Cable Line.

cable being made with a single set of potheads.

In another instance a 13,000-volt transmission line was carried through the center of a city using an overhead cable hung in catenary suspension. This construction was adopted because of the need of quick supply and because construction difficulties prevented the use of open-wire lines. The accompanying illustration shows the general scheme adopted in building this line and also shows how the corners were turned and how the corner poles were braced.

LINE CONSTRUCTION ROPES TESTED FOR CONDUCTIVITY.

Hand-Line Rope Is Found to Have Low Resistance Because of a Fine Steel Wire Woven in Its Strands.

By F. A. KENDIG.

The Dayton Power & Light Co., Dayton, O., recently had rather an unfortunate experience in the use of ropes on 6600-volt lines. The trouble resulted from the use of a coil of half-inch rope bought, from the regular supply house, as the best grade of manila rope. One line crew was working over a 6600-volt line and as the groundman took hold of the lead-line he was severely shocked and slightly burned. Another line crew shorted a 6600-volt line and a street-light patrolman was severely shocked when he allowed his hand line to drag over a railway feeder. These three accidents, taking place in two days, attracted considerable attention resulting in the calling in of all ropes for a high-tension test.

All of the rope from this one particular coil broke down at from 500 to 7000 volts per foot, while other samples withstood 36,000 volts per foot. All of the rope from this coil was immediately taken out of service and, on investigation, was found to contain a small steel wire 0.007 in. in diameter. The wire was difficult to find, but was finally located by fringing and burning off several inches of the strands. The rope contained the usual marker, but the manufacturer claimed that by mistake the strand containing the steel wire, which is used as a marker for another style of rope, had also been included in the coil.

In order to prevent the chance of such an accident being repeated, this company now tests all new ropes at high potential before they are placed in stock.

PROCEDURE REQUIRED TO DRY OUT LARGE TRANSFORMERS.

Two to Three Weeks Drying Runs Are Made on 5000-Kw. Transformers Before They Are Placed in Service.

The starting of large high-voltage transformers requires a great amount of care to assure their going into service in good condition. The precautions outlined below were taken by the testing department of the Edison Electric Illu-

minating Co., of Boston, Mass., in drying out the transformers installed in its Baker street substation, which is of the outdoor type. There are three 5000-kw. transformers at this station, power being received at 66,000 volts.

To dry the transformers it was necessary to build a temporary portable house over the top of the transformers and to place blowers and electric heaters inside the house, so that a continuous stream of hot air could be forced into the transformers to dry them and drive out the last vestige of moisture. These drying runs were continued night and day for a period of from two to three weeks on each transformer. This work occurred during a period of bad weather, rain and freezing nights, which lengthened the time necessary to do the drying and added to the difficulty of the work.

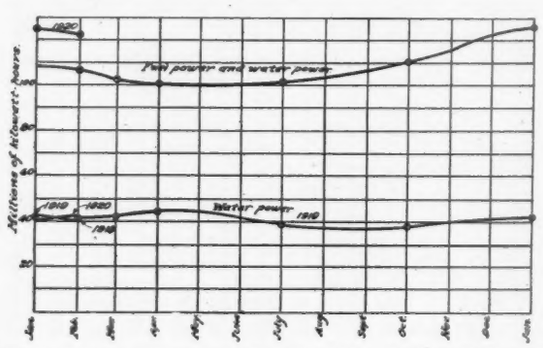
Insulation-resistance readings and temperatures were taken throughout the drying period and were used as a guide to determine the condition of the transformers. At the conclusion of the drying runs all water and oil connections were examined for tightness, the laboratory oil-filtering outfit was set up and 11,000 gals. of transil oil was filtered into the three transformers. Numerous samples of oil were taken and tested for dielectic strength. The results of these tests showed that the oil was in such condition that refiltering and circulating the oil, a process often necessary, was not needed.

EFFICIENCY OF POWER PRODUCTION IN UNITED STATES.

Report Shows a Wide Variation in the Economy of Producing Electric Power in Various States of the Country.

Power appears to be generated in the United States at the average rate of 660 kw-hrs. per ton of coal consumed, according to a recent bulletin of the Department of the Interior. This bulletin states that about 458,000,000 tons of bituminous coal was produced in the United States in 1919 and that 7.6% of this coal was used by electric public utility plants.

From an analysis of the data covering coal consumed and power generated, it appears that electric power is generated at from 338 to 854 kw-hr. per ton of coal consumed. The states of



Daily Average Power Produced in the United States by Public-Utility Plants.

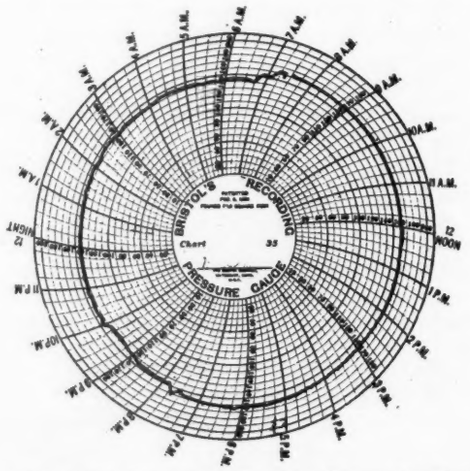
Pennsylvania, New York and Illinois use the most coal, New York generates the most power and Massachusetts generates power at the highest efficiency per ton.

The accompanying illustration shows the average daily power generated by water and by both fuel and water for 1919 and the first two months of 1920, in public-utility plants. The fuel items include coal, oil and gas.

GOOD STEAM CHART DRAWN WITH AUTOMATIC STOKERS.

Mechanical Stokers Help to Maintain Uniform Pressure, Reduce Operating Troubles and Secure Full Boiler Outputs.

Uniformity of steam pressure is vital to the satisfactory and economical operation of almost every type of steam-operated equipment. Engines, turbines, pumps and heating and cooking equipment are all designed for definite steam pressure and, while they may operate over a fairly large pressure range, will not give maximum or economic service on a fluctuating pressure. The boiler plant itself does not deliver



Steam Chart Taken in Plant Fired by Automatic Stokers.

its full capacity or maximum efficiency with fluctuating pressure and wide variations in pressure are usually accompanied by rapid deterioration of boilers, boiler settings and pipe lines.

The steam chart shown in the accompanying illustration was taken recently in the plant of the Fall River Bleachery, Fall River, Mass. This plant is equipped with 12 Manning boilers of 150 hp. each and three Manning boilers of 230 hp. each. The smaller boilers are fired by one and the larger boilers by two Jones underfeed stokers per boiler.

OUTDOOR SUBSTATION FOR BOSTON EDISON SYSTEM.

A new outdoor-type of substation will be constructed and connected to the system of the Edison Electric Illuminating Co., Boston, Mass., at the corner of Dorchester avenue near Freeport street to take over part of the load of the circuits from the Zeigler street station in this immediate vicinity. The station will receive its service from an existing transmission line for distribution, at 2300 volts single-phase and 4000 volts three-phase, to the circuits in the immediate vicinity. A set of transformers totaling 2000 kw. in capacity will comprise the initial installation at this station.

NEW APPLIANCES

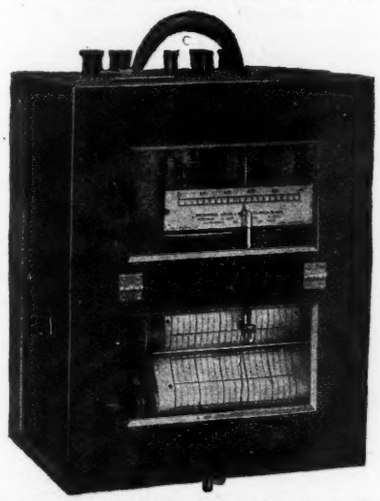
Newly Developed and Improved Electrical and Mechanical Apparatus, Appliances, and Devices Now Being Placed on the Market

Motor-Operated Switchboard and Portable Graphic Instruments.

Various improvements have been announced, by the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., in the construction of its type M graphic instruments for switchboard and portable use.

Heretofore, pens were driven by solenoids damped by dash pots, whereas they are now driven by a small motor actuated by contacts in the main circuit. Damping is accomplished by means of permanent magnets on an aluminum disc attached to the shaft of the pen-operating motor. Flexibility is increased in the new design, and the mechanical balance of the motor-operating element is good and easy to maintain. The external resistance is in a compact unit-form so that interconnections can be made to allow any instrument to operate on a control voltage of 110 volts d-c. or on 25 or 60 cycles a-c.

The instrument has been reduced in weight by the use of a bakelite-micarta base with a metallic rim. The case consists of a wooden frame with glass windows, making it easy to see the entire mechanism without removing the case. The paper reroll is driven over an intermediate shaft in the clock which in turn is driven



Motor-Operated Graphic Instrument for Portable or Stationary Service.

directly from the motor and not through the clock spring or any of the clock mechanism.

These instruments are made for operation as a-c. ammeters and voltmeters, single and polyphase a-c. wattmeters, frequency meters and d-c. voltmeters.

An Electric Furnace Economizer.

The gases generated in an electric furnace during operations are combustible at high temperatures when these gases escape uncooled to the atmosphere, they are hot enough to burn, and in so doing they burn up part of the electrode itself, and have objectionable effects on the electrode holder. While these gases are inside the furnace they are under reducing conditions, and have, therefore, only their own sensible heat and no heat generated by the oxidation of combustible constituents.

Electric Furnace Construction Co., Philadelphia, Pa., has developed an economizer designed for cooling furnace gases, as they pass out of the

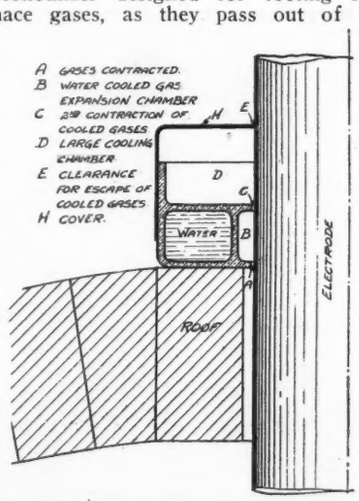


Diagram of Economizer Designed to Cool Gases Escaping From an Electric Furnace.

furnace, and so prevent their burning when they come in contact with the open air. The gas, in escaping from the furnace, first passes between the electrode and the port-hole of the roof, then through a small clearance space and into a water-cooled chamber around the electrode. Heat is given up, in this chamber, and absorbed by the water in the cooling ring. The gases then pass through another small opening into a larger chamber where still more heat is given up and carried away by radiation from the walls of the chamber. From this last space the gases pass out to the atmosphere at temperatures too low to ignite.

It is claimed that the graphite electrode used can be reduced from about 30 lbs. to about 12.5 lbs. per ton of steel by the use of this economizer.

Small Size Induction Motors.

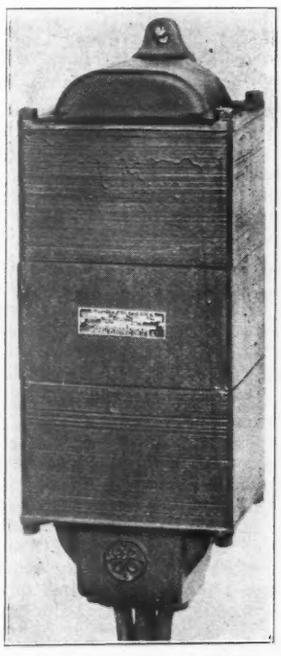
A line of small and medium-size induction motors is being manufactured by William B. Durgin Co., Concord, N. H. These motors are known to the trade as Crawford induction motors, and are made in sizes from ⅙ to 15 hp., and for 110 or 220-volt, 60-cycle service. Motors for higher voltage are made on special order.

The star-delta connection is used on all motors above 5 hp. in capacity. This connection brings out six leads from the motor winding, and when used in connection with a star-delta switch, proves practical, according to the claims made, when the starting load is not over 60% of the full-load torque. This practice of bringing out six leads from the winding does not interfere with the use of compensators or other starting devices necessary for starting large loads.

Auto-Transformer for Two to Three-Phase Service.

There are still many plants in operation generating two-phase power. On account of the fact that three-phase equipment is now more popular, it is becoming increasingly difficult to purchase motors for these two-phase systems. In order to make possible the use of three-phase motors on two-phase, four-wire circuits, the General Electric Co., Schenectady, N. Y., has developed a line of unity-ratio auto-transformers for phase transformation.

These transformers, which may be



Auto-Transformer for Two-Phase to Three-Phase Tranformation.

used to convert three-phase to two-phase or two-phase to three-phase current, are made in nine standard sizes of from 1 to 25-kv-a. capacity. They are air cooled and are suitable for either indoor or outdoor operation on 220-volt circuits of from 50 to 140 cycles. The transformers of this particular design cannot be used in connection with three-wire, two-phase service or to operate motors with interconnected phases.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Selected Electric Appliance Co., Inc., 251 Weybosset street, Providence, R. I., has increased its capital stock from $60,000 to $125,000.

Delta-Star Electric Co., 2433 Fulton street, Chicago, has moved its Philadelphia, Pa., office from No. 902 Real Estate building to No. 1333 the same buildng.

Butterfly Phonograph Motor Corp., 243 West 17th street, New York City, manufacturer of motors for talking machine service, has filed notice of the dissolution of the company.

Contra-Pole Electric Co., 1231 Prospect place, Brooklyn, N. Y., manufacturer of electric specialties, has filed notice of an increase in its capital stock from $100,000 to $155,000.

Page Steel & Wire Co., 1054 Grand Central Terminal, New York City, has removed its central district sales office from 29 South La Salle street to 208 South La Salle street, Chicago.

Godfrey Conveyor Co., Elkhart, Ind., has issued a large folder describing the advantages the company claims for its conveyor, a blue print showing in detail the work of the machine.

Benjamin Electric Manufacturing Co., 806 West Washington boulevard, Chicago, is sending to the trade a facsimile page advertisement on industrial lighting that the company is placing in publications of nation-wide circulation.

Eureka Vacuum Cleaner Co., Detroit, Mich., is sending to the trade two large folders giving the repair parts price list together with charts showing the exact place on the vacuum cleaner that each of the parts specified in the price list is located.

Electric Storage Battery Co., Allegheny avenue and 19th street, Philadelphia, Pa., announces the removal of its Cleveland offices from 1217 Citizens building to Chester avenue and East 24th street. The new offices will occupy the entire second floor of the "Exide" battery service station, extensive alterations having been made to accommodate the offices. H. F. Sauer is acting manager of the Cleveland office.

Ajax Electrothermic Corp., Camden, N. J., has been incorporated to take over the manufacture of the Ajax-Northrup high-frequency furnace from the Pyrolectric Instrument Co. and the Northrup patents from the Ajax Metal Co., Philadelphia. It is proposed to operate at the former plant of the Pyrolectric company, 636 East State street, Trenton, N. J. G. H. Clamer is president; E. F. Northrup, vice-president; H. F. Porter, treasurer and works manager, and Dudley Willcox, secretary and sales manager of the corporation.

Edward A. Everett, manufacturer of railroad and signal appliances, Long Island City, N. Y., announces the removal of his sales office and factory to new and larger quarters at 136 West avenue.

Hart & Hegeman Manufacturing Co., Hartford, Conn., manufacturer of electric switches, etc., has awarded a contract for the erection of a three-story and basement brick and reinforced concrete building.

Baer, Cooke & Co. is the new name of the engineering company formerly known as Carl A. Baer & Co., with office in the Land Title building, Philadelphia, Pa. The change in the company name became effective June 1.

Puffer-Hubbar Manufacturing Co., Minneapolis, Minn., is sending the trade an illustrated booklet descriptive of the "Daylight" washing machine manufactured by the company. The machine is operated by a ¼hp. a-c. or d-c. electric motor.

Blaw-Knox Co., Pittsburgh,, Pa., manufacturer of transmission towers, etc., has arranged for the issuance of preferred stock for $2,000,000. The company has filed notice of an increase in its capital stock from $3,000,000 to $14,000,000, for general business expansion.

Roller-Smith Co., 233 Broadway, New York City, announces that it has made an agency arrangement with the W. Montelius Price Co., 524 First avenue South, Seattle, Wash., whereby the latter company will handle the Roller-Smith line of electrical instruments and circuit breakers in the states of Washington and Idaho and part of the state of Oregon.

Inland Electric Co., 15 North Franklin street, Chicago, through its fixture department, is sending to the trade a folder showing the advantages claimed by the company for its "Steelite" portable extension fixtures for use in industrial plants both as a protection against fire loss and also in the cheapening of insurance rates, as well as gains in efficiency, working service, etc.

Diamond Power Specialty Co., Detroit, Mich., has available for distribution three copies of its four-reel motion picture "Coal Is King," which was originally prepared as a part of the coal conservation campaign. The film deals with good and bad methods of coal mining and transportation, good and bad methods of firing, combustion losses and their minimization and management of the boiler room in general. The company is willing to loan the film free of charge to engineering clubs and societies, commercial organizations, manufacturers' associations, technical schools and educational departments of large corporations.

Edward Miller & Co., Meriden, Conn., manufacturers of lamps, heaters, etc., has taken bids for the construction of a five-story brick and mill type factory building on Center street.

Westinghouse, Church, Kerr & Co. Inc., announces the removal of its New York City office from 37 Wall street to 125 East 46th street. Until the completion of the merger of the company with Dwight P. Robinson & Co., Inc., of which due announcement will be made, the business will be conducted under the present name.

Ward Electric Co., Inc., Stock Exchange building, Philadelphia, Pa., manufacturer of standard electrical wiring devices, is sending to the trade its catalog No. 1 in which the foreword reads in part as follows: "We desire to state that while we are new as a corporation, the management and manufacturing are in the hands of those who have been associated with the electrical industry for a number of years." The company manufactures switch plugs, fuses, receptacles, etc.

Westinghouse Lamp Co., 165 Broadway, New York City, in its policy to create a better co-operative spirit between its own organization and distributors of Westinghouse Mazda lamps will hold a conference at its main plant, Bloomfield, N. J., June 23-25, when the following subjects will be taken up for discussion: "The Aims and Purposes of the Jobber Agents," by W. T. Blackwell; "Merchandising of Incandescent Lamps by the Electrical Dealers," by S. A. Chase; "General Sales Policy of the Westinghouse Lamp Co.," by Elliot Reid; "New Incandescent Lamps and Their Fields of Application," by A. R. Dennington; "Testing Incandescent Lamps as a Check on Quality," by H. S. Dunning; "Engineering and Research Laboratories of the Westinghouse Lamp Co. and Their Bearing on the Incandescent Lamp Industry," by Dr. R. E. Myers; "Industrial Lighting as a Field for Business Building," by S. G. Hibben; "The Functions of the 'B' Agents and Developing a Distribution System," by W. W. Briggs; "Value of the Service Record," by C. R. Ramsey; "The Westinghouse Lamp Co.'s Plants and New Additions," by H. S. Black; "Lamp Transportation Situation," by C. E. Clark; "How the Commercial Engineering Department Can Aid the Lamp Agent," by W. T. Blackwell; "What Will Be Seen in the Plant," by F. M. Wicks; "How to Use the Advertising Service," by F. W. Prince; "Merchandising Incandescent Lamps and Handling Lamp Stocks," by C. Beard. In addition to the long program for discussion there will be an exhibit of lamps and an inspection trip through the Bloomfield plant.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

C. W. WOOD has been appointed chief engineer of the South San Joaquin (Cal.) Irrigation District.

CLINTON E. HAVER has accepted a position as works engineer of the Hooven & Allison Co., Xenia, O.

HOWARD J. MCLEAN, Calgary, Alta., has been appointed junior hydro-electric engineer of the Alberta reclamation service, with headquarters at Calgary.

GEORGE E. LONG, senior vice-president of the Joseph Dixon Crucible Co., Jersey City, N. J., has retired from that office after 43 years of service with the company.

E. C. HARDER who has been connected with the U. S. Geological Survey for several years, has accepted a position with the Aluminum Co. of America, Pittsburgh, Pa.

A. B. CONNELL, Woodstock, N. B., has been appointed chairman of the Public Utilities Commission of New Brunswick. He succeeds G. O. D. Otty, whose term of office expired recently.

ERWIN A. WEISS has resigned as assistant manager of methods with the Isko Refrigerator Co., Chicago, to accept a position as service engineer with the Mitchell Motors Co., Racine, Wis.

LAURENCE W. HAYES has resigned as Cleveland (O.) sales manager for the Worthington Pump & Machinery Corp. and is now associated with F. N. Hayes and J. N. Hayes in Boston, Mass.

E. M. CARR has resigned as superintendent of the Columbus (Ind.) municipal electric light plant, to accept a position as superintendent of the Logansport (Ind.) municipal electric light plant.

H. W. JARRETT, formerly assistant fuel engineer, U. S. Bureau of Mines, Pittsburgh, Pa., has assumed the duties of sales engineer with the George J. Hagan Co., combustion engineer, Pittsburgh, Pa.

LYLE B. MARCY, formerly superintendent of the Hart & Cooley Co., Inc., New Britain, Conn., has become connected with the Chase Companies, Inc., Waterbury, Conn., in the capacity of research engineer.

EDWIN T. EMERSON, assistant division superintendent of the New England Telephone & Telegraph Co., Portland, Me., has resigned to accept a position with the investment banking house of Hollister, White & Co., Boston, Mass.

W. JERRY STANTON, well known in the electrical industry, has become associated with the Ohio Brass Co., Mansfield, O. Mr. Stanton was with the General Electric Co. for 18 years, serving in the testing, engineering and sales departments, and has also been with the Railway Improvement Co., and the National Railway Appliance Co.

P. B. WESSON has left the Clinton-Wright Wire Co., Clinton, Mass., where he was employed six years as mechanical superintendent and has been made secretary of the Hampden Brass Co., Springfield, Mass.

LEE H. NEWBERT, who was elected president of the Pacific Coast Section of the National Electric Light Association at its annual meeting in May, has been connected with the electrical industry since 1900, having spent all

Lee H. Newbert.

that time with the Pacific Gas & Electric Co., or its subsidiary companies. He entered the office of the Marysville (Cal.) Gas & Electric Co. in 1900 and in 1904 was made manager of the company. In 1906 he was made district manager of the Pacific Gas & Electric Co. at Redwood, Cal., and in 1911 was made manager of the appliance department of the company, with headquarters in San Francisco. In 1917 he became manager of the commercial department, which position he now holds. Mr. Newbert for several years has devoted considerable time to the development of the co-operative idea in the electrical industry in California, and when the California Electrical Co-operative Campaign was launched in January, 1918, he was made chairman of the advisory committee. The work performed by him as chairman of this committee was largely responsible for his election to the presidency of the Pacific coast section.

THORNDYKE SAVILLE, professor of hydraulic and sanitary engineering at the University of North Carolina, has been appointed hydraulic engineer for the North Carolina Geologic and Economic Survey in charge of an investigation of the water resources of North Carolina.

J. A. BURNETT, electrical engineer, Montreal, Que., has been appointed to assist in the valuation of the electrical equipment of the St. Clair river tunnel, the Oshawa Electric railroad and the Montreal & Southern Counties railroad. The appraisal is being made for the Grand Trunk railway interests.

DR. JOHN BOSWELL WHITEHEAD, professor of electrical engineering at Johns Hopkins University, Baltimore, Md., has been appointed dean of the department of engineering of the institution. This is a new office and places the engineering department on an equality with the College of Arts and Sciences and the School of Medicine. Dr. Whitehead was graduated from the Johns Hopkins electrical engineering department in 1893 and for three years was in the employ of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Later he became connected with the Niagara Falls Power Co., Niagara Falls, N. Y. He returned to Johns Hopkins University in 1897 and received a degree of bachelor of arts, and in 1902 was made a doctor of philosophy and received a research fellowship in Carnegie Institute of Technology. He has been professor of electrical engineering at Johns Hopkins since 1914.

OBITUARY.

FRANK C. NEWELL, electrical and mechanical engineer employed by the Interborough Rapid Transit Company, of New York City, died on May 28, aged 65 years.

J. A. CRAIG, of Montreal, one of the pioneers of the electrical industry in Canada, died recently at Montreal, aged 83 years. Mr. Craig was a builder of dynamos, and turned out what is believed to be the first electrical dynamo ever made in Canada.

W. E. MILLS, general superintendent of the Holt Manufacturing Co., Peoria, Ill., died recently, following an illness of several months. Mr. Mills was a pioneer in the building of armored tanks for war use and was chief supervisor for the army department at the Peoria plants during the war period.

JOHN BOGART, who was a pioneer in the water-power development of Niagara Falls, died recently at his home in New York City, aged 84 years. Mr. Bogart served in the Civil War, emerging from the conflict with the rank of colonel, and later was engineer for the Brooklyn Park Commission and the Brooklyn Rapid Transit Commission. He was the engineer for the Niagara Falls Power Co., which built the first shaft and tunnel for the development of hydroelectric power at Niagara Falls, and since then has been associated with a number of important hydroelectric projects on the St. Lawrence river, the Sault Ste. Marie river, on the Pacific coast and in other sections of the country.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

Rochester, N. H. — The New Hampshire Telephone & Telegraph Co., Masonic building, Dover, N. H., has awarded a contract to Lord & Allen, Rochester, for the erection of a two-story telephone building, about 30 by 40 ft.

Springfield, Mass.—The United Electric Co., New London, Conn., has awarded a contract to A. E. Stephens & Co., 264 Main street, Springfield, for the erection of a large transformer building, estimated to cost about $200,000, including equipment. The company has also arranged for the construction of a new substation at North and Carew streets.

Providence, R. I.—The Narragansett Electric Co. has recently closed a number of contracts for electric energy covering a total in excess of 10,000 hp.

Providence, R. I.—The Brite-Lite Manufacturing Co. has filed notice of organization with capital stock of $50,000. E. Engatoff, John M. Otar and George Coby, 146 Smith street, are interested in the company.

Bridgeport, Conn.—The United Illuminating Co., 84 Temple street, New Haven, Conn., is receiving bids through its architects and engineers, Westcott & Mapes, Inc., 207 Orange street, New Haven, for the construction of the superstructure of its brick, concrete and steel power plant located along the Pequonnock river at Bridgeport. The project is estimated to cost in excess of $1,000,000.

New Britain, Conn.—The American Hardware Corp. has awarded a contract to William H. Allen Company, Hungerford Place, for the erection of a new one-story brick transformer house at its plant.

Waterbury, Conn.—The Connecticut Light & Power Co., 111 West Main street, has awarded a contract to D. Wooster, 39 Harvard street, for the erection of a two-story power house addition on Freight street, about 25 by 85 ft. The structure is estimated to cost $10,000.

Brooklyn, N. Y.—Plans have been completed by the Brooklyn Edison Co., 360 Pearl street, for the construction of a one-story brick power house at 57 Washington avenue. The structure will be about 40 by 100 ft. and is estimated to cost $40,000.

Buffalo, N. Y.—Considerable refrigerating machinery, electrical equipment, etc., will be required in connection with the construction of an ice cream manufacturing plant by the Spark Dairy Co., 146 Prospect street, estimated to cost approximately $50,000. Contract for the new plant has been awarded to Metz Brothers, 1295 Fillmore avenue.

Long Island City, N. Y.—The Astoria Light, Heat & Power Co., 130 East 15th street, New York City, is arranging for the immediate construction of a boiler plant, on Winthrop avenue, near Van Alst avenue. The structure will be two-story, brick, about 49 by 85 ft., and is estimated to cost $55,000, including machinery and equipment installation.

Massena, N. Y.—The Aluminum Co. of America, manufacturer of heavy electrical cables, etc., is understood to be considering plans for the construction of an addition to its local plant. The project is estimated to cost in excess of $200,000.

New York, N. Y.—Announcement has been made that the Swedish Parliament, Stockholm, Sweden, has granted 2,000,000 kroner to be used for the construction of a large wireless station for communication with the United States.

New York, N. Y.—The New York Telephone Co., 15 Dey street, is arranging for a total of 68 building operations throughout New York to provide a total of 1,000,000 additional square feet of operating space for its increased business. At the present time the company has under way about 20 projects, estimated to cost $6,000,000, while the proposed work will bring the total expenditure up to about $26,000,000. It has been stated that the company handles a total of about 4,300,000 calls every 24 hours.

New York, N. Y.—The New York Edison Co., Irving place and 15th street, is having plans prepared for the construction of a substation, to be located on Elizabeth street, near Canal street.

New York, N. Y.—The House Waves Construction Co., 67 Liberty street, has had plans prepared for the construction of a one-story pumping building at its properties on 177th street, near the Bronx river. The structure is estimated to cost about $7500.

Niagara Falls, N. Y.—National Carbon Co., College avenue, has completed arrangements for the construction of a one-story, brick and steel addition to its plant, about 25 by 300 ft. Contract for the structure, which is estimated to cost about $100,000, has been awarded to the J. W. Cowper Co., Fidelity building, Buffalo, N. Y.

North Tonawanda, N. Y.—The Niagara Radiator & Boiler Co., Oliver street, manufacturer of radiators, boilers, etc., will build a one-story addition to its plant, about 70 by 190 ft., to cost $150,000, with machinery and equipment. Contract for erection has been awarded to the Lackawanna Bridge Co., Bell and Abby streets, Buffalo, N. Y.

Potsdam, N. Y.—The St. Lawrence Transmission Co. has filed notice of an increase in its capital stock from $3,000,000 to $3,250,000.

Rocky Point, L. I., N. Y.—The Radio Corp. of America, Woolworth building, New York City, has awarded a contract to the J. G. White Engineering Corp., 43 Exchange place, New York City, for the construction of a radio plant. It is understood that the station will have a diameter of more than 3 mi., with 12 sets of antennae strung to 72-ft. self-supporting steel towers 400 ft. high, located within about 2 mi. of the central power plant. The entire project is estimated to cost in excess of $5,000,000.

Allentown, N. J.—The borough council has taken bids for the installation of a quantity of new equipment for the municipal power plant. The work will include new generator, producer, gas engine, switchboard, piping, etc.

Bloomingdale, N. J.—The borough council is understood to be considering plans for the installation of an electric street lighting system throughout the municipality.

Dover, N. J.—Arrangements have been completed by the government for the erection of a power house, steel stack and installation of equipment at the Picatinny Arsenal.

Kearny, N. J.—Until June 15, the board of education will receive bids for electrical work in connection with alterations and improvements at the Lincoln school. M. J. Malnati is secretary.

Newark, N. J.—Samuel Jones & Co., 37 McClellan street, manufacturer of gummed paper, has had plans prepared for the erection of a new boiler plant, about 40 by 45 ft., at their plant to cost about $13,000. An extension will also be made to the manufacturing plant to cost about $7000.

Newark, N. J.—George W. Goethals & Co., 40 Wall street, New York City, has secured an interest in the Splitdorf Electrical Co., 98 Warren street, Newark, and in the future will be associated in the management of the plant and business. It is said that operations will be continued as heretofore with no change in present organization.

Pompton Lakes, N. J.—The borough council is receiving bids for the rebuilding of the section of the municipal electric power plant recently damaged by breakage.

Pompton Plains, N. J.—The Boonton Electric Co. has recently filed application with township committee for permission to extend its lines for the furnishing of electric energy to

the Lincoln Park district of the township.

Trenton, N. J.—The South Jersey Gas, Electric & Traction Co. has had plans prepared for the construction of a new one-story brick building on Chauncey street, estimated to cost about $12,000.

Blossberg, Pa.—The board of managers of the Blossberg Hospital has completed plans for the construction of a power house and laundry building at the institution, estimated to cost about $20,000.

Connellsville, Pa.—Large quantities of electrical and mechanical equipment will be utilized in connection with the construction of the local plant of the Paragon Motor Car Co. The works, it is understood, will comprise a group of one-story buildings, and will be devoted to motor car production; the buildings are estimated to cost close to $1,000,000, including machinery and equipment installation.

Dormont, Pa.—The Bell Telephone Co. of Pennsylvania has awarded a contract to A. & S. Wilson, 541 Third avenue, Pittsburgh, Pa., for the construction of a new addition and alterations and improvements in the existing telephone building. The work is estimated to cost $35,000.

East McKeesport, Pa.—The East McKeesport Water Co. has been ordered by the Public Service Commission to make improvements and repairs in the entire pumping apparatus for furnishing water supply to the borough of Wall.

Harrisburg, Pa.—Notices have been filed by a number of public utility companies of Pennsylvania of intention to issue bonds, stock, etc., for general expansion. Among these concerns are: Penn Central Power & Transmission Co., Altoona, bonds, $150,000; Pennsylvania Utilities Co., Easton, bonds, $137,000; Metropolitan Edison Co., Reading, bonds, $292,000; Scranton Electric Co., Scranton, bonds, $190,000; Pennsylvania Lighting Co., Philadelphia, bonds, $558,000; Lykens Valley Light & Power Co., Philadelphia, bonds, $73,000; Penn Central Light & Power Co., Altoona, bonds, $251,000; Reading Transit & Light Co., Reading, equipment bonds, $50,000.

Harrisburg, Pa.—Arrangements are being made for the installation of wireless telephone equipment in the headquarters and at the barracks of the state police force. It is proposed to install similar equipment for the use of the forestry service, to aid in giving warnings of fires, etc.

Harrisburg, Pa.—The city has commenced work on the installation of new electrically operated traffic standards in the Market Square district.

Jersey Shore, Pa.—The Susquehanna Silk Mills Co. has awarded a contract to the Foundation Co., 1324 Fulton building, Pittsburgh, for the erection of a new three-story addition to the power plant at its silk mills. The structure will be about 40 by 60 ft., and is estimated to cost $150,000, including machinery and equipment.

Kane, Pa.—The city council has voted to install electric lights on the city streets.

Philadelphia, Pa.—The Montgomery Transit & Light Co. has filed notice of an increase in its capital stock from $1,000,000 to $1,500,000.

Philadelphia, Pa.—McCray & Hunter, 3526 Germantown avenue, have awarded a contract for the erection of a two-story addition to their cold storage plant, about 109 by 122 ft. Alterations and improvements will also be made in the existing structure, the entire work being estimated to cost about $25,000. J. V. Looux, 3731 Old York road, is the contractor on the project.

Pittsburgh, Pa.—The West Penn Power Co. has been granted a permit for the construction of a power line containing sixteen 22,000-volt wires over the Allegheny river, in the vicinity of Lock No. 3.

Spangler, Pa.—The Penn Central Co. is having plans prepared for the construction of a transformer station, to facilitate operations. Day & Zimmerman, Inc., 611 Chestnut street, Philadelphia, is the engineer on the project.

Baltimore, Md.—The Consolidated Gas, Electric Light & Power Co. is understood to have arranged for the purchase of property between Graves and Constitution streets. It is said that the tract will be used for future plant expansion.

Emmitsburg, Md.—In connection with the construction of a power plant at the Mt. St. Mary's College, plans have been arranged for a new transmission line to extend about 1300 ft. Rev. B. J. Bradley is manager at the institution.

Washington, D. C.—The Chesapeake & Potomac Telephone Co. has been granted permission by the Utilities Commission of the District of Columbia to increase its rates for service sufficiently to bring the net return to a total of $605,000 annually. The company is a subsidiary of the New York Telephone Co.

Wheeling, W. Va.—The Wheeling Electric Co. is having plans prepared for extensions and improvements in its system to provide for increased capacity. The proposed work includes the establishment of a new power loop to extend to Windsor, W. Va., preliminary work on which will be inaugurated within three weeks. The new loop will be constructed via Fulton at the Rudler district, at which latter point a new substation will be erected. J. B. Garden is the plant superintendent.

Red Springs, N. C.—The town council is arranging plans for the construction of an electric light plant to be used for municipal service. Gilbert C. White, Durham, N. C., is the engineer on the project.

Abbeville, S. C.—E. W. Gregory, Greenwood, S. C., has purchased the Abbeville Telephone Co. for $25,000.

Madison, Ga.—The city plans extensive improvements in its electric light plant.

Sandersville, Ga.—The city council has voted in favor of the issuance of bonds for $40,000, the proceeds to be used to cover the cost of the rebuilding of the municipal electric light plant, recently destroyed by fire, as well as for other improvements.

St. Petersburg, Fla.—The city will vote June 18 on the issuance of $20,000 in bonds for the installation of an electric light system on Central avenue, First and Ninth streets.

Tampa, Fla.—The city has issued $280,000 in bonds for the purpose of erecting a power plant and improving the water works system.

NORTH CENTRAL STATES.

Columbiana, O.—The Pennsylvania-Ohio Electric Co. will furnish the city with light and power.

Williams, Ind.—The Southern Indiana Power Co. will construct a high-voltage transmission line from its central plant at Williams to Edwardsport. The line will have 60,000-volt capacity. W. E. Murchie is the manager of the company.

Evansville, Ind.—An electrical show to be held at the Soldiers and Sailors' Memorial Coliseum is planned by the electrical contractor-dealers of the city. It is proposed to hold the show next October.

St. Joseph, Mich.—The General Electric Co., Schenectady, N. Y., has prepared plans for a system of curb lighting for the business streets. The Chamber of Commerce is behind the plan for better lighting on the streets.

Glenwood, Wis.—The city contemplates the establishment of a "white way" system of lighting on its principal streets.

Newton, Ill.—The city will expend $50,000 in the improvements in its electric light plant. Fuller Beard, Chemical building, St. Louis, Mo., is the engineer in charge of the project and will receive bids for the work.

Redwood Falls, Minn.—The Redwood Falls Electric Telephone Co. will erect a telephone exchange building.

Marshalltown, Ia.—The Marshall Electric Co. has been granted permission to extend its transmission lines from Haverhill to Laurel.

St. Louis, Mo.—The board of aldermen has voted $1,000,000 in bonds for the purpose of establishing a municipal street-lighting system.

Versailles, Mo.—The Versailles Flour Mill, Ice & Power Co. plans to increase its power-plant capacity by the installation of a new 130-hp. motor.

Nebraska City, Neb.—The Nebraska City Electric Light Co. is planning the extension of its transmission lines to Dunbar, Oteo, Avoca, Syracuse, Julian, Talmage and Brock.

Collison, Kan.—The city has voted $15,000 in bonds for the purpose of constructing a transmission line from Collison to Pratt, Kan.

SOUTH CENTRAL STATES.

Georgetown, Ky.—Plans have been prepared by W. H. Weiss, consulting engineer, for the improvement of the city's electric light service. Address C. L. Sebree, city clerk, for further information.

Alcoa, Tenn.—A series of dams will give the Aluminum Co. of America power plant at Alcoa 400,000 hp. instead of 80,000 hp. as originally planned. Construction work on the

dams and power plant will start in the near future, according to B. L. Glascock, superintendent of the company.

Memphis, Tenn. — The Memphis Gas & Electric Co. is considering plans for the immediate construction of a three-story, reinforced concrete booster station. The structure is estimated to cost about $25,000.

Birmingham, Ala.—The Alabama Power Co. and the Georgia Power Co., Atlanta, Ga., have entered into a contract to build a transmission line from Gadsden, Ala., to Linsdale, Ga., a distance of 52 mi.

Fairfield, Ala.—The Birmingham Railway, Light & Power Co., Birmingham, Ala., is having plans prepared for the installation of a new electric lighting system at Fairfield.

Shubuta, Miss.—The town council is planning for the installation of an electric light plant for municipal service. It is proposed to issue bonds to cover the cost of the proposed work. J. P. Spinks is mayor of the town.

Monroe, La. — The Cumberland Telephone & Telegraph Co. is understood to be having plans prepared for the rebuilding of its telephone system, to facilitate operations. The work is estimated to cost about $75,000.

St. Joseph, La.—The city is contemplating a bond issue for the purpose of building an electric light plant.

Russelville, Ark.—The Arkansas Light & Power Co., Little Rock, Ark., contemplates the erection of a 25,000,-kw. power plant at Russelville to connect by transmission lines with the Picron and Pine Bluff plants.

Stuttgart, Ark. — The American Tractor & Harvester Co. will equip a plant for the manufacture of tractors at an estimated cost of $100,000.

Pawnee, Okla.—The city has voted $100,000 in bonds for the purpose of improving the electric light and water plants.

Houston, Tex. — The Houston Lighting & Power Co. will construct a 2300-volt service line to take care of customers on West University place.

Houston, Tex.—It is authoritatively announced that the work of constructing the grade for the Houston, Richmond & San Antonio Traction Co.'s proposed interurban electric railway between Houston and San Antonio, 225 mi., will be resumed immediately.

Toyah, Tex.—The city council has granted a franchise to Jesse Knight for the construction and operation of an electric light and power plant here.

Vernon, Tex.—According to A. V. Foster, president of the Texas Public Service Co., an expenditure of approximately $100,000 will be made in additions to the company's electric light and power plant if it is found upon investigation that conditions warrant the proposed outlay of money.

WESTERN STATES.

Centralia, Wash.—The Kane Pneumatic Shock Absorber Co. will erect a power plant to supply power to its plant at Ford's Prairie. The plant will geenrate from 750 to 1500 kw.

Centralia, Wash. — The Carlisle-Pennell Lumber Co. is making rapid progress on the installation of a 2500-hp. steam turbine, to be used in connection with the electrification of its plant at Onalaska.

Everett, Wash.—The city is considering plans for extensions and improvements in the electric light and power system. The work is estimated to cost about $50,000.

Everett, Wash.—Work has recently been inaugurated and rapid progress is being made by the Weyerhaeuser Timber Co. on the complete electrification of its mill "A" on the waterfront.

Klamath Falls, Ore.—W. B. Parker, local manager of the Klamath Development Co., and associates, have completed negotiations for the purchase of the Keno Power Co. for a consideration said to be about $80,000. The property includes the power plant at Keno, transmission lines, and other holdings.

El Segundo, Cal.—Considerable electrical and mechanical equipment will be utilized in connection with the manufacturing plant of the General Chemical Company, 25 Broad street, New York City, estimated to cost close to $2,000,000, including machinery and equipment. The J. G. White Engineering Corp., 43 Exchange place, New York City, is the engineer on the work.

Los Angeles, Cal.—The Carbasemo Co., manufacturer of soaps, etc., is having plans prepared for the construction of a steam-operated electric power plant, to be used in connection with its works to be located at Burbank, Cal. The project is estimated to cost about $200,000, and machinery will be operated by individual motor drive wherever possible. H. J. Knauer, 1129 Story building, Los Angeles, is the architect on the project.

Los Angeles, Cal.—The City Railway Co. has had plans prepared for the construction of a double track electric railway system along Temple street, extending from Spring to Los Angeles streets. The company also plans the construction of a similar system along Western avenue, from Melrose avenue to Santa Monica boulevard.

Los Angeles, Cal.—The Los Angeles Gas & Electric Corp., has been granted permission by the State Railroad Commission to issue $1,000,000 in bonds for the purpose of making improvements and additions in equipment.

McFarland, Cal.—A committee has been appointed to organize a community power plant. George Carter and Carl Melcher are at the head of the movement.

Riverside, Cal.—The Southern Sierras Power Co. is having plans prepared for the construction of a two-story steel and concrete addition to its local power plant. The structure will cost about $50,000.

San Bernardino, Cal.—The Southern California Edison Co. and the Southern Sierras Power Co. has arranged for the joint installation of a new frequency changer at the steam plant of the latter company at San Bernardino. The work will cost about $250,000.

San Francisco, Cal.—The Doble Co., Call building, is understood to be arranging plans for the erection of a plant at Emeryville for the manufacture of engines, tractors, etc. Hutchinson & Mills, Oakland, are the architects on the project.

San Francisco, Cal.—Arrangements have been completed by the Byron Jackson Iron Works, New Montgomery street, manufacturer of centrifugal pumps, etc., for the construction of a plant to be located in the Huntington Park section of Los Angeles. Contract for the works, which are estimated to cost about $75,000, has been awarded to George Wagner, 251 Kearny street, San Francisco.

Susanville, Cal.—The Lassen Electric Co. has been granted permission by the State Railroad Commission to issue bonds for $100,000, the proceeds to be used for the construction of a transmission line from Susanville, Lassen County, to Westwood, about 25 mi.

Woodland, Cal.—Plans are being prepared by officials of Reclamation District No. 8 for the immediate construction of a large steam-operated electric power plant. The works will be located in the vicinity of Knight's Landing, and are estimated to cost approximately $80,000.

CANADA.

Chesley, Ont.—W. G. Durst is in the market for three-phase, a-c., 220-volt electric motors, ranging in capacity from 2 to 15 hp.

Ottawa, Ont.—The Dominion of Canada department of public works will call for bids in the near future for the construction of a drydock at Esquimault, B. C., estimated to cost $1,500,000. Considerable electrical equipment will be installed in the drydock. R. C. Desrochers, Ottawa, Que., is secretary of the department.

Peterboro, Ont. — The Canadian General Electric Co., 212 West King street, Toronto, Ont., has let the contract for an addition to its plant and equipment at Peterboro to John E. Hayes, 219 Park street. The improvements will cost about $500,000.

Toronto, Ont.—The Canadian Dyers' Association, Ltd., 2 Liberty street, will build an addition to its boiler shop at an estimated cost of $20,000.

INCORPORATIONS.

New York, N. Y.—The Waterside Electric Co. Capital stock, $10,000. To manufacture electrical specialties. Incorporators: B. H. Ellis, W. D. Henbury, and J. P. Perass, Brooklyn, N. Y.

Buffalo, N. Y.—The Phelps Sales Corp. Capital stock, $40,000. To manufacture lighting machinery, etc. Incorporators: E. J. Kusel, S. L. Reilly, and S. M. Finch, Buffalo.

Philadelphia, Pa.—The Union Electric Motor Co. Capital stock, $20,000. To manufacture electric motors, etc. Incorporators: J. Vernon Pimm, E. M. MacFarland, and F. R. Hansell.

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Mr. C. A. Tupper,
President,
International Trade Press,
542-53 Monadnock Block,
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May 17, 1920

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FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

New York Edison Co.

The annual report of the New York Edison Co. (controlled by the Consolidated Gas Co.) for the year ended Dec. 31, 1919, as submitted to the State Public Service Commission, shows surplus after charges and taxes, of $7,246,137, equivalent to $10.98 a share earned on the $65,945,417 capital stock as compared with surplus of $5,183,745, or $7.86 a share in the preceding year.

Income account for the year 1919 compares with 1918 as follows:

	1919.	1918.
Operating revenue	$28,793,272	$25,329,203
Operating income after expenses and taxes	9,104,192	6,643,763
Charges	1,858,055	1,460,018
Balance	$ 7,246,137	$ 5,183,745
Dividends	4,616,178	4,616,178
Balance	$ 2,629,959	$ 567,567
Addition to surplus	26,429	141,620
Previous surplus	36,925,824	36,323,410
Total surplus	$39,582,212	$37,032,597
Other reductions	44,899	106,773
Profit and loss surplus	$39,537,313	$36,925,824

Philadelphia Co. Net $3,796,065.

The Philadelphia Co. has issued its pamphlet report covering the year ended Dec. 31, 1919. Net income after charges amounted to $3,796,065, equivalent after preferred dividends to $3.23 a share earned on the $42,043,000 common stock ($50 par value) for the period. The previous annual report covered the nine months period ended Dec. 31, 1918, and showed $3.58 a share earned on the common stock. The income account for the year ended Dec. 31, 1919, compares as follows:

	Yr. end. Dec. 31, '19.	9 mos. end. Dec. 31, '18.
Gross earnings	$13,774,501	$9,636,415
Expenses and taxes	7,193,000	4,795,477
Net earnings	$ 6,581,501	$4,840,938
Other income	2,070,040	1,659,796
Total income	$ 8,651,541	$6,500,734
Interest and charges	4,855,476	3,067,182
Net income	$ 3,796,065	$3,433,552
Preferred stock dividends	1,015,084	357,264
Common stock dividends	2,576,434	1,932,273
Surplus	$ 204,547	$1,144,015

United Gas & Electric Corp.

	1920.	1919.
March gross	$1,029,637	$ 854,141
Net after taxes	334,940	270,560
Total income	337,060	272,263
Surplus after charges	174,869	120,396
Twelve months' gross	10,974,841	9,337,392
Net after taxes	3,888,644	3,078,986
Total income	3,925,041	3,110,007
Surplus after charges	2,075,957	1,310,806

Subsidiary operating companies controlled by the United Gas & Electric Corp.:

	1920.	1919.
April gross	$ 887,799	$ 840,223
Net after taxes	326,588	275,858
Total income	329,790	277,355
Surplus after fixed charges	171,298	124,042
Twelve months' gross	11,122,417	9,457,263
Net after taxes	3,939,377	3,109,058
Total income	3,977,479	3,139,899
Surplus after fixed charges	2,115,623	1,334,503

Alabama Power Co.

	1920.	1919.
April gross	$ 330,392	$ 220,581
Net after taxes	195,652	122,452
Twelve months' gross	3,446,988	3,111,059
Net after taxes	1,932,378	1,591,611

Duquesne Light Co.

The Duquesne Light Co. for the year ended Dec. 31, 1919, reports surplus after charges of $3,224,617. The previous annual report covered the nine months ended Dec. 31, 1918, and showed surplus of $1,575,667:

	12 mos. end. Dec. 31, '19.	9 mos. end. Dec. 31, '18.
Gross	$11,917,566	$8,737,717
Net after taxes	4,411,965	3,330,461
Other income	202,465	46,423
Total income	$ 4,614,430	$3,376,884
Surplus after charges, etc.	3,224,617	1,575,667
Preferred stock dividends	446,398	309,878
Common stock dividends	1,458,080	1,139,130
Surplus	$ 1,320,139	$ 126,659

Fort Worth Power & Light Co.

	1920.	1919.
March gross	$ 158,510	$ 101,859
Net after taxes	90,224	51,113
Total income	90,762	51,560
Surplus after charges	77,416	38,715
Twelve months' gross	1,552,680	1,293,459
Net after taxes	782,899	581,191
Total income	789,984	584,365
Surplus after charges	630,576	434,004
Balance after preferred dividends	529,951	339,590

Carolina Power & Light Co.

	1920.	1919.
April gross	$ 129,084	$ 98,705
Net after taxes	42,091	37,155
Total income	45,725	38,968
Surplus after charges	28,308	23,208
Twelve months' gross	1,364,470	1,075,865
Net after taxes	416,725	360,312
Total income	580,319	515,556
Surplus after charges	386,435	329,240
Balance after dividends	256,816	203,604

Lake Shore Electric Co.

The Lake Shore Electric Railway Co. reports the following comparative statement of earnings for the year ended Dec. 31, 1919:

	1919.	1918.
Gross earnings	$2,067,225	$1,734,660
Net earnings	577,180	472,860
Surplus after charges	237,379	129,357

Northern Ohio Electric Corp. and Subsidiaries.

	1920.	1919.
April gross	$ 962,371	$ 723,397
Net earnings	340,050	270,152
Surplus after charges	151,541	110,225
Balance after preferred dividends	121,541	80,225
Twelve months' gross	10,188,418	7,833,519
Net earnings	3,451,897	2,628,171
Surplus after charges	1,347,092	771,484
Balance after preferred dividends	987,092	411,484

Twin City Rapid Transit Co.

	1920.	1919.
April gross	$1,017,813	$ 882,230
Net earnings	292,043	262,840
Surplus after charges	106,813	105,420
Four months' gross	4,135,037	3,500,724
Net earnings	987,076	904,951
Surplus after charges	240,709	276,030

New England Power System.

	1920.	1919.
April gross	$ 461,478	$ 289,847
Net after taxes	161,132	138,931
Surplus after charges	93,219	74,124
Twelve months' gross	4,794,400	3,769,852
Net after taxes	1,508,475	1,440,769
Surplus after charges	743,082	719,182

Dividends.

The St. Louis (Mo.) Power & Light Co. has declared its regular quarterly dividend of 1¾% on its preferred stock, payable June 1 to stockholders of record May 21.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid May 25.	Bid June 1.
Adirondack Electric Power of Glens Falls, common	6	10½	10
Adirondack Electric Power of Glens Falls, preferred	6	65	68
American Gas & Electric of New York, common	10+extra	100	95
American Gas & Electric of New York, preferred	6	37	37
American Light & Traction of New York, common	..	135	138
American Light & Traction of New York, preferred	6	79	80
American Power & Light of New York, common	4	50	45
American Power & Light of New York, preferred	6	65	65
American Public Utilities of Grand Rapids, common	..	3	3
American Public Utilities of Grand Rapids, preferred	7	11	12
American Telephone & Telegraph of New York	..	100	101
American Water Works & Elec. of New York, common	..	2	2
American Water Works & Elec. of New York, particip	7	6	6
American Water Works & Elec. of New York, first preferred	..	40	38
Appalachian Power, common	..	2	2
Appalachian Power, preferred	7	13	14
Cities Service of New York, common	+extra	330	330
Cities Service of New York, preferred	6	65	64
Commonwealth Edison of Chicago	8	102	100
Comm. Power, Railway & Light of Jackson, common	..	18	18
Comm. Power, Railway & Light of Jackson, preferred	6	35	37
Federal Light & Traction of New York, common	..	6	6
Federal Light & Traction of New York, preferred	..	44	41
Middle West Utilities of Chicago, common	..	18	18
Middle West Utilities of Chicago, preferred	..	30	32
Northern States Power of Chicago, common	..	35	35
Northern States Power of Chicago, preferred	ex.div.7	77	77
Pacific Gas & Electric of San Francisco, common	..	57	58
Public Service of Northern Illinois, Chicago, common	7	75	75
Public Service of Northern Illinois, Chicago, preferred	6	78	78
Standard Gas & Electric of Chicago, common	..	14	14
Standard Gas & Electric of Chicago, preferred	6	35	36
Tennessee Railway, Light & Power of Chattanooga, common	..	1	1
Tennessee Railway, Light & Power of Chattanooga, preferred	6	3	3
United Light & Railways of Grand Rapids, common	4	18	18
United Light & Railways of Grand Rapids, preferred	6	57	56
Western Power of San Francisco, common	..	14	14
Western Union Telegraph of New York	extra	82	82
Industrials—			
Electric Storage Battery of Philadelphia, common	4	102	103
General Electric of Schenectady	8	175	175
Westinghouse Electric & Mfg. of Pittsburgh, common	7	53	54